ORIGINAL TO GENERAL FILES

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

OFFICE OF DESIGN POLICY & SUPPORT
INTERDEPARTMENTAL CORRESPONDENCE

FILE P.I. # 132986-
BRST0-0189-01(030)
Gwinnett County
GDOT District 1 - Gainesville
SR 120/Duluth Hwy @ Singleton Creek
Bridge Replacement

OFFICE Design Policy & Support

DATE May 12, 2016

FROM for Brent Story, State Design Policy Engineer

TO SEE DISTRIBUTION

SUBJECT **APPROVED REVISED CONCEPT REPORT**

Attached is the approved Revised Concept Report for the above subject project.

Attachment

DISTRIBUTION:

Hiral Patel, Director of Engineering
Joe Carpenter, Director of P3/Program Delivery
Genetha Rice-Singleton, Assistant Director of P3/Program Delivery
Albert Shelby, State Program Delivery Engineer
Darryl VanMeter, State Innovative Delivery Engineer
Bobby Hilliard, Program Control Administrator
Cindy VanDyke, State Transportation Planning Administrator
Eric Duff, State Environmental Administrator
Bill DuVall, State Bridge Engineer
Andrew Heath, State Traffic Engineer
Angela Robinson, Financial Management Administrator
Lisa Myers, State Project Review Engineer
Charles "Chuck" Hasty, State Materials Engineer
Lee Upkins, State Utilities Engineer
Richard Cobb, Statewide Location Bureau Chief
Brent Cook, District Engineer
Brandon Kirby, District Preconstruction Engineer
Robby Oliver, District Utilities Engineer
Anthony Tate, Project Manager
BOARD MEMBER - 7th Congressional District

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA
PROJECT CONCEPT REPORT

Project Type:	Bridge Replacement	P.I. Number:	132986
GDOT District:	1	County:	Gwinnett
Federal Route Number:	N/A	State Route Number:	120
	Project Number:	N/A	

The project consists of the replacement of the SR 120 bridge over Singleton Creek to the south of the existing structure as well as 0.4 miles of realignment of SR 120.

Submitted for approval:

Michael Baker International, Inc. — Consultant Designer & Firm — Date: 1/27/2016

Albert V. Shelby — State Program Delivery Engineer — Date: 3.1.16

Anthony Tello — GDOT Project Manager — Date: 2/16/16

Recommendation for approval:

* Eric DuFF /KLP — State Environmental Administrator — Date: 3-17-16

* Christopher Raymond /KLP — State Traffic Engineer — Date: 3-24-16

FOR * Lisa Myers — Project Review Engineer — Date: 3-18-16

State Utilities Engineer — Date

District Engineer — Date

* Bill DuVall — State Bridge Engineer — Date: 4-22-16

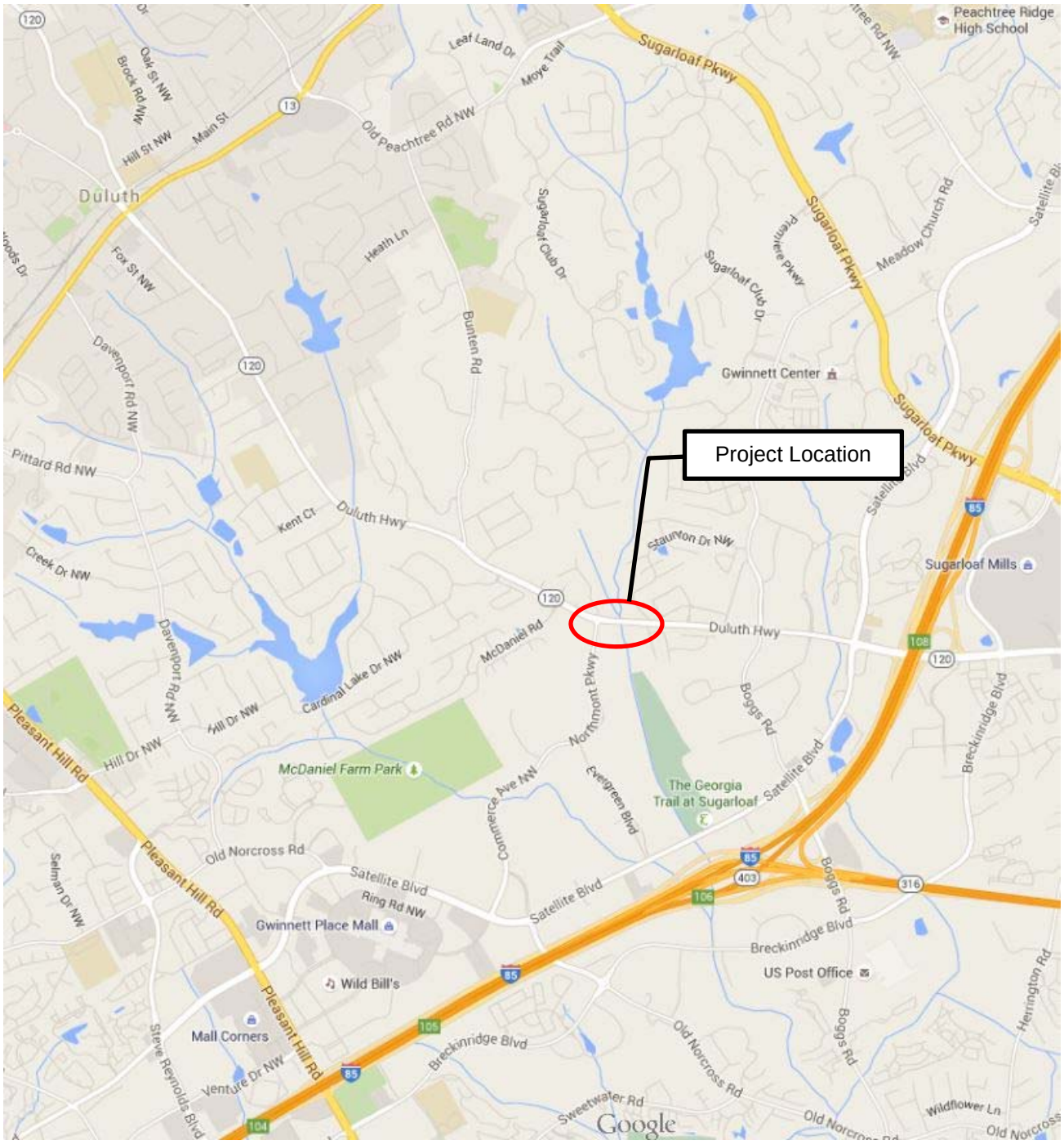
☒ MPO Area: This project is consistent with the MPO adopted Regional Transportation Plan (RTP)/Long Range Transportation Plan (LRTP).

☐ Rural Area: This project is consistent with the goals outlined in the Statewide Transportation Plan (SWTP) and/or is included in the State Transportation Improvement Program (STIP).

Cynthia L Vaughn — State Transportation Planning Administrator — Date: 3-21-16

* Recommendations on file

PROJECT LOCATION MAP



PLANNING AND BACKGROUND

Project Justification Statement:
The bridge on SR 120 (Duluth Highway) over Singleton Creek, Structure ID 135-0023-0, was built in 1938. The original bridge consists of three spans of steel beams on concrete caps and concrete columns. This bridge was designed using an H-15 vehicle, which is below current design standards. The overall condition of this bridge would be classified as satisfactory. The deck is in fair condition with the concrete edge beams exhibiting cracking and spalling throughout the structure. The superstructure is in good condition. The substructure is in satisfactory condition with minor concrete deterioration consisting of cracking and spalling of the concrete cap at bent 2 and abutment 4. The bridge is classified as having an unknown foundation and therefore could be at risk for scour. Due to the structural integrity of the bridge pertaining to the design vehicle, deterioration of the edge beams throughout the structure and the unknown foundation of the substructure, replacement of this bridge is recommended.

Existing conditions:
Existing SR 120 consists of two 12-foot lanes with variable width paved shoulders. Left and right turn lanes provided at the existing intersections. The existing bridge over Singleton Creek consists of two 12-foot lanes with no shoulders. There is a signalized intersection of SR 120 and Northmont Pkwy 450 feet west of the existing bridge. There is existing sidewalk to the east and west of the bridge. Overhead electric transmission lines and a gas line are located on the south side of the road through the project corridor. A sanitary sewer line follows Singleton Creek perpendicular to SR 120. The north side of the bridge is protected under a restrictive covenant by the Corps of Engineers and cannot be impacted without significant costs and impacts to the schedule.

Other projects in the area: None

MPO: Atlanta Regional Commission (ARC)

TIP #: GW-290

TIA Regional Commission: Atlanta Regional Commission

Congressional District(s): 7

Federal Oversight: ☐ PoDI ☒ Exempt ☐ State Funded ☐ Other

Projected Traffic: ADT 24 HR T: 8 %
Current Year (2015): 25,300 Open Year (2020): 26,600 Design Year (2040): 32,450
Traffic Projections Performed by: Michael Baker International, Inc., Approved 8/14/2015

Functional Classification (Mainline): Urban Minor Arterial Street

Complete Streets - Bicycle, Pedestrian, and/or Transit Standard Warrants:
Warrants met: ☐ None ☒ Bicycle ☒ Pedestrian ☐ Transit
Bicyle Warrants – The corridor includes bicycle generators including residential development. The project is a new bridge.
Pedestrian Warrants - The corridor inludes pedestrian generators including residential neighborhoods.
Transit Warrants – The route is not located along a transit corridor per Gwinnett County transit maps.

Is this a 3R (Resurfacing, Restoration, & Rehabilitation) Project? ☒ No ☐ Yes

Pavement Evaluation and Recommendations

Initial Pavement Evaluation Summary Report Required? ☐ No ☒ Yes
Intial Pavement Type Selection Report Required? ☒ No ☐ Yes
Feasible Pavement Alternatives: ☒ HMA ☐ PCC ☐ HMA & PCC

DESIGN AND STRUCTURAL

Description of the proposed project:
The project consists of replacement of the existing SR 120 bridge over Singleton Creek. The total project length is 0.4 miles The project is located in Gwinnett County, 1.2 miles east of the City of Duluth. The new bridge will include two 12' lanes plus a center turn lane and sidewalks for pedestrians.

Major Structures:

Structure	Existing	Proposed
135-0023-0 SR 120 over Singleton Creek	75 feet long, 26.5 foot wide deck with two 12 foot lanes and no shoulder. Suffieciency rating of 58.7 per inspection dated 1/31/2014.	150 foot long bridge with three 50-foot spans. The total width is 63.42-foot including two 12-foot travel lanes and a 14-foot center turn lane with 2-foot gutters and 5.5-foot raised sidewalks.

Mainline Design Features: SR 120 – Urban Minor Arterial

Feature	Existing	Standard*	Proposed
Typical Section			
- **Number of Lanes**	**2**	**4**	**2**
- **Lane Width(s)**	**12-ft**	**11-12-ft**	**12-ft**
- **Median Width & Type**	**None**	**24-ft Raised**	**14-ft Flush**
- **Outside Shoulder or Border Area Width**	**Varies**	**10-16-ft**	**16-ft**
- **Outside Shoulder Slope**	**Vaires**	**2%**	**2%**
- **Inside Shoulder Width**	**N/A**	**N/A**	**N/A**
- **Sidewalks**	**5-ft**	**5-ft**	**5-ft**
- **Auxiliary Lanes**	**Left & Right turn lanes**	**None**	**Left & Right turn lanes**
- **Bike Lanes**	**None**	**None**	**4-ft**
Posted Speed	**45 mph**		**45 mph**
Design Speed		**45 mph**	**45 mph**
Min Horizontal Curve Radius	**1650**	**711**	**2000**
Maximum Superelevation Rate	**6%**	**4%**	**6%****
Maximum Grade	**6.3%**	**7%**	**6.3%**
Access Control	**By Permit**	**By Permit**	**By Permit**
Design Vehicle		**WB-40**	**WB-40 (Min)*****
Pavement Type	**Ashpalt**		**Ashpalt**

*According to current GDOT design policy if applicable
** 6% SE rate will be used to match existing. 4% will be used on all new location areas.
*** Turning movements for WB-67 will be analyzed to/from SR 120 to Northmont Pkwy south due to the number of industrial businsess located in this area.

Major Interchanges/Intersections:
SR120 @ Northmont Pkwy – Existing Signalized Intersection

Lighting required: ☒ No ☐ Yes

Off-site Detours Anticipated: ☒ No ☐ Yes ☐ Undetermined

Transportation Management Plan [TMP] Required: ☐ No ☒ Yes
If Yes: Project classified as: ☒ Non-Significant ☐ Significant
TMP Components Anticipated: ☒ TTC ☐ TO ☐ PI

Design Exceptions to FHWA/AASHTO controlling criteria anticipated:

FHWA/AASHTO Controlling Criteria	No	Undeter-mined	Yes	Appvl Date (if applicable)
1. Design Speed	☒	☐	☐	
2. Lane Width	☒	☐	☐	
3. Shoulder Width	☒	☐	☐	
4. Bridge Width	☒	☐	☐	
5. Horizontal Alignment	☒	☐	☐	
6. Superelevation	☒	☐	☐	
7. Vertical Alignment	☒	☐	☐	
8. Grade	☒	☐	☐	
9. Stopping Sight Distance	☒	☐	☐	
10. Cross Slope	☒	☐	☐	
11. Vertical Clearance	☒	☐	☐	
12. Lateral Offset to Obstruction	☒	☐	☐	
13. Bridge Structural Capacity	☒	☐	☐	

Design Variances to GDOT Standard Criteria anticipated:

GDOT Standard Criteria	Reviewing Office	No	Undeter-mined	Yes	Appvl Date (if applicable)
1. Access Control/Median Openings	DP&S	☒	☐	☐	
2. Intersection Sight Distance	DP&S	☒	☐	☐	
3. Intersection Skew Angle	DP&S	☒	☐	☐	
4. Lateral Offset to Obstruction	DP&S	☒	☐	☐	
5. Rumble Strips	DP&S	☒	☐	☐	
6. Safety Edge	DP&S	☒	☐	☐	
7. Median Usage	DP&S	☒	☐	☐	See note below
8. Roundabout Illumination Levels	DP&S	☒	☐	☐	
9. Complete Streets	DP&S	☒	☐	☐	
10. ADA & PROWAG	DP&S	☒	☐	☐	
11. GDOT Construction Standards	DP&S	☒	☐	☐	
12. GDOT Drainage Manual	DP&S	☒	☐	☐	
13. GDOT Bridge & Structural Manual	Bridges	☒	☐	☐	

Note: A flush median is used for SR 120 because it is a two lane facility. No projects are programmed to widened SR 120 in the vicinity of this project which would then require a raised median. See Concept Team Meeting notes for discussion.

VE Study anticipated: ☒ No ☐ Yes ☐ Completed – Date:

UTILITY AND PROPERTY

Temporary State Route needed: ☒ No ☐ Yes ☐ Undetermined

Railroad Involvement: None

Utility Involvements:
Georgia Power Distribution– Electric
AT&T (Transmission and Distribution) – Telecommunications
Atlanta Gas Light – Gas
Gwinnett County Department of Water Resources – Water & Sewer
Charter – Telecommunications
Jackson EMC – Electric
Level 3 – Telecommuncations
Zayo Telecom - Telecommunications

SUE Required: ☐ No ☒ Yes ☐ Undetermined

Public Interest Determination Policy and Procedure recommended? ☒ No ☐ Yes

Right-of-Way (ROW): Existing width: 80-120 ft. Proposed width: 100-190 ft.
Required Right-of-Way anticipated: ☐ None ☒ Yes ☐ Undetermined
Easements anticipated: ☐ None ☒ Temporary ☒ Permanent ☐ Utility ☐ Other

Anticipated total number of impacted parcels:		10
Displacements anticipated:	Businesses:	0
	Residences:	0
	Other:	0
	Total Displacements:	0

Location and Design approval: ☐ Not Required ☒ Required

Impacts to USACE property anticipated? ☐ No ☒ Yes ☐ Undetermined

ROUNDABOUTS
None

CONTEXT SENSITIVE SOLUTIONS
Issues of Concern: None

Context Sensitive Solutions Proposed: None

ENVIRONMENTAL & PERMITS
Anticipated Environmental Document:
GEPA: ☐ **NEPA:** ☒ CE ☐ EA/FONSI ☐ EIS

MS4 Permit Compliance – Is the project located in a MS4 area? ☐ No ☒ Yes
As outlined in the attached MS4 Concept Layout, of the five identified drainage areas, three will have a reduction in total pavement area, meaning no post construction BMPs will be required. A fourth area, drainage area 5 is located directly adjacent to a townhome neighborhood and would not permit construction without impacts to those properties. Drainage Area 3 will require post construction BMPs which can be located within the existing R/W on the north side of the existing roadway. Costs are included in the construction cost estimate.

Environmental Permits/Variances/Commitments/Coordination anticipated:

Permit/ Variance/ Commitment/ Coordination Anticipated	No	Yes	Remarks
1. U.S. Coast Guard Permit	☒	☐	
2. Forest Service/Corps Land	☒	☐	

3. CWA Section 404 Permit	☐	☒	Wetland impacts
4. 33 USC 408 Decision	☒	☐	
5. Tennessee Valley Authority Permit	☒	☐	
6. Buffer Variance	☐	☒	Possible for Singleton Creek
7. Coastal Zone Management Coordination	☒	☐	
8. NPDES	☐	☒	
9. FEMA	☐	☒	
10. Cemetery Permit	☒	☐	
11. Other Permits	☒	☐	
12. Other Commitments	☒	☐	
13. Other Coordination	☒	☐	

Is a PAR required? ☒ No ☐ Yes ☐ Completed – Date:

Environmental Comments and Information:

NEPA/GEPA: The CE has not been started outside of special studies being completed. No out of the ordinary issues are anticipated. No 4f resources are present in the project corridor.

Ecology: An ecology survey has been completed and identified two wetlands and three buffered waters. No suitable habitiat was identified for T&E species. An aquatic study has been completed and the determination was that Singleton Creek is not suitable habitat for potentially affected species. The property to the north of the project on either side of Singleton Creek is a wetland preservation area protected under USACOE restrictive covenant no. 2005-01245.

History: A historic survey has been conducted of the project corridor and no resources were identified.

Archeology: An archaeological survey has been conducted of the project corridor and no resources were identified.

Air Quality:

Is the project located in a PM 2.5 Non-attainment area? ☐ No ☒ Yes
Is the project located in an Ozone Non-attainment area? ☐ No ☒ Yes
Carbon Monoxide hotspot analysis: ☒ Required ☐ Not Required ☐ TBD

The project is exempt from the conforming plan because it is a widening of an existing bridge with no change to the number of travel lanes.

Noise Effects:
A noise impact assessment report (screening) is required.

Public Involvement:
No formal public involvement is anticipated at this time.

Major stakeholders:
Gwinnett County, City of Duluth, Traveling Public, Local Homeowners

CONSTRUCTION

Issues potentially affecting constructability/construction schedule: No issues identified

Early Completion Incentives recommended for consideration: ☒ No ☐ Yes

COORDINATION, ACTIVITIES, RESPONSIBILITIES, AND COSTS

Initial Concept Meeting: The ICM was held on 6/5/2002 and the CR was first approved on 2/11/2003. The original CR and included ICM meeting minutes are attached. Due to the length of time since the original concept was developed, the changes to the project corridor and the additional requirements of Concept Reports it was decided to complete a new Concept Report instead of a Concept Validation and/or Concept Revision.

Concept Meeting:
The Concept Team Meeting was held on 12/18/2015 at the District 1 Office and the project site. The meeting mintues are attached.

Other coordination to date: None

Project Activity	Party Responsible for Performing Task(s)
Concept Development	Michael Baker International, Inc.
Design	Michael Baker International, Inc.
Right-of-Way Acquisition	GDOT
Utility Coordination (Preconstruction)	Michael Baker International, Inc.
Utility Relocation (Construction)	Utility Companies
Letting to Contract	GDOT
Construction Supervision	GDOT
Providing Material Pits	GDOT
Providing Detours	N/A
Environmental Studies, Documents, & Permits	Michael Baker International, Inc.
Environmental Mitigation	GDOT
Construction Inspection & Materials Testing	GDOT

Project Cost Estimate Summary and Funding Responsibilities:

	Breakdown of PE	ROW	Reimbursable Utility	CST*	Environmental Mitigation	Total Cost
Funded By	GDOT	GDOT	GDOT	GDOT	GDOT	
$ Amount	$300,000	$492,000	$928,500	$3,072,019	$48,280	$4,840,799
Date of Estimate	3/15/2013	1/14/2016	1/27/2016	4/20/2016	10/21/2015	

*CST Cost includes: Construction, Engineering and Inspection, Contingencies and Liquid AC Cost Adjustment. CE&I of 5% of CES total and Contingency of 10% of CES plus CE&I cost included.

ALTERNATIVES DISCUSSION

Alternative selection:

Preferred Alternative: Replace the bridge to the south of the existing alignment			
Estimated Property Impacts:	**10**	**Estimated Total Cost:**	**$4,840,799**
Estimated ROW Cost:	**$492,000**	**Estimated CST Time:**	**24 months**
Rationale: This alternative meets the project goals by replacing the existing deficient bridge while allowing traffic to be maintained on the existing structure.			

No-Build Alternative: The existing bridge will be left in place with no improvements			
Estimated Property Impacts:	**None**	**Estimated Total Cost:**	**$0**
Estimated ROW Cost:	**$0**	**Estimated CST Time:**	**N/A**
Rationale: The No-Build alternative fails to meet the project need of replacing the existing substandard width bridge.			

Alternative 1: Replace the bridge to the north of the existing alignment			
Estimated Property Impacts:	**11**	**Estimated Total Cost:**	**Not analyzed**
Estimated ROW Cost:	**Not analyzed**	**Estimated CST Time:**	**24 months**
Rationale: This alternative cannot be accomplished without impacting the property to the north of the existing bridge which is protected by the Corps through a restrictive covenant. This alternative would also impact Intermittent Streams 1 & 4.			

Alternative 2: Replace the bridge on the existing alignment			
Estimated Property Impacts:	**3**	**Estimated Total Cost:**	**Not analyzed**
Estimated ROW Cost:	**Not analyzed**	**Estimated CST Time:**	**36 months**
Rationale: This alternative would require construction of a temporary detour bridge in order to remove the existing bridge and reconstruct it at the required elevation above the design year flood event. Construction of the temporary paving and bridge would occur generally in the same location as the southern or northern alternative resulting in similar levels of impacts with the additional costs associated with temporary construction.			

Comments: None

LIST OF ATTACHMENTS/SUPPORTING DATA

1. Concept Layout
2. Typical sections
3. Detailed Cost Estimates:
    a. Construction including Engineering and Inspection and Contingencies
    b. Completed Liquid AC Cost Adjustment forms
    c. Revisions to Programmed Costs & Contigency Summary
    d. Right-of-Way
    e. Utilities
    e. Environmental Mitigation
4. Crash summaries
5. Traffic diagrams
6. Capacity analysis summary
7. Summary of TE Study
8. S I & A Report
9. Concept Level Hydrology Study for MS4 Permit
10. Pavement Study
11. Minutes of Concept meetings

APPROVALS

Concur: Hiral Patel
Director of Engineering

Approve: Margaret B. Pickell 5.10.16
Chief Engineer Date

LEGEND

- PROPOSED PAVEMENT
- PROPOSED SIDEWALK
- PROPOSED BRIDGE
- PROPOSED R/W
- EXISTING R/W
- EXISTING PROPERTY LINE
- EXISTING UTILITY EASEMENT
- ENVIRONMENTALLY SENSITIVE AREA

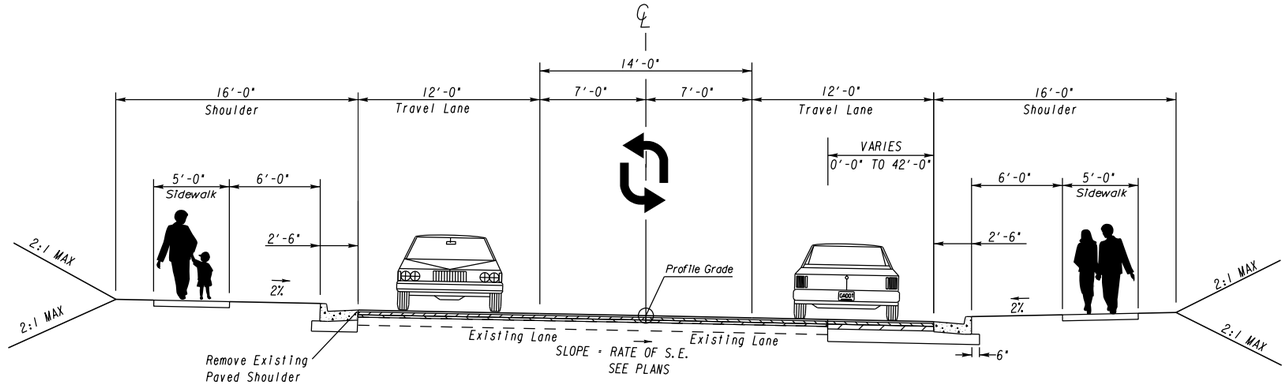
Michael Baker
INTERNATIONAL
420 TECHNOLOGY PKWY, SUITE 150
NORCROSS, GEORGIA 30092
(770) 263-9118

CONCEPT LAYOUT
P. I. 132986
SR 120 @ SINGLETON CREEK
GWINNETT COUNTY
APRIL 20, 2016

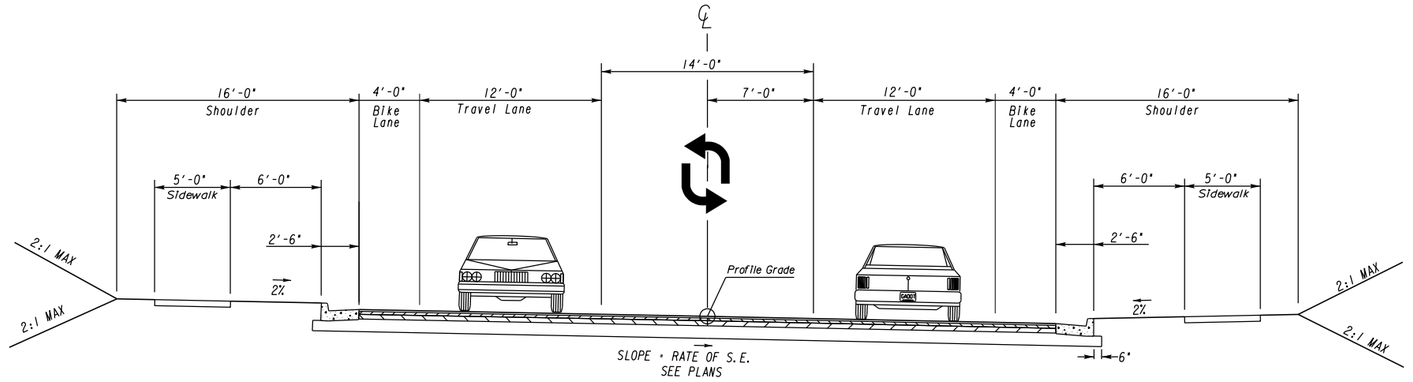
SCALE IN FEET
0 100 200 400

N

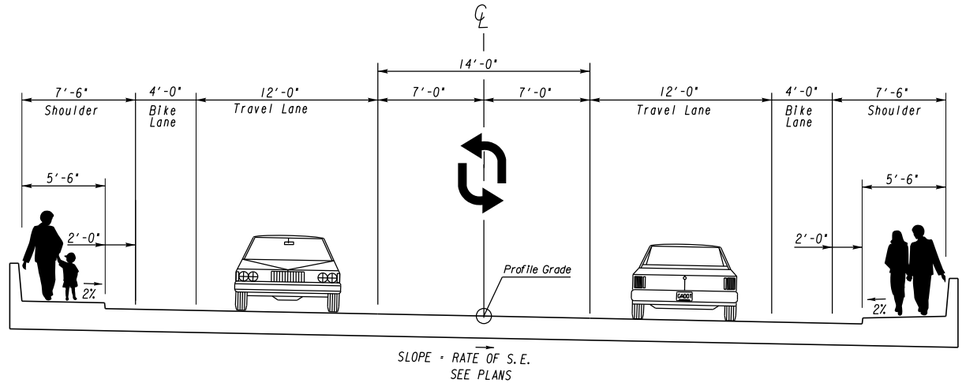
TYPICAL SECTION #1
WIDENING SUPER ELEVATED SECTION
EAST OF NORTHMONT PKWY
& WEST OF STAUNTON DR



TYPICAL SECTION #2
FULL DEPTH SUPER ELEVATED SECTION
NORTHMONT PKWY TO
STAUNTON DR



TYPICAL SECTION #3
SUPER ELEVATED BRIDGE SECTION



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ROADWAY DESIGN

REVISION DATES

TYPICAL SECTIONS

SR120/DULUTH HWY. OVER SINGLETON CREEK

CHECKED:		DATE:		DRAWING No.
BACKCHECKED:		DATE:		05-0001
CORRECTED:		DATE:		
VERIFIED:		DATE:		

JOB ESTIMATE REPORT

JOB NUMBER : 132986 SPEC YEAR: 13
DESCRIPTION: SR 120 AT SINGLETON CREEK

ITEMS FOR JOB 132986

LINE	ITEM	ALT	UNITS	DESCRIPTION	QUANTITY	PRICE	AMOUNT
0005	150-1000		LS	TRAFFIC CONTROL - 132986	1.000	200000.00	200000.00
0010	153-1100		EA	FIELD ENGINEERS OFFICE TP 1	1.000	85000.00	85000.00
0015	210-0100		LS	GRADING COMPLETE - 132986	1.000	400000.00	400000.00
0020	310-1101		TN	GR AGGR BASE CRS, INCL MATL	2500.000	26.47	66190.03
0025	318-3000		TN	AGGR SURF CRS	100.000	26.07	2607.54
0029	402-1801		TN	RECYL AC PATCHING, INCL BM	200.000	90.00	18000.00
0030	402-1812		TN	RECYL AC LEVELING,INC BM&HL	1000.000	91.24	91243.69
0035	402-3130		TN	RECYL AC 12.5MM SP,GP2,BM&HL	1100.000	95.35	104886.31
0040	402-3121		TN	RECYL AC 25MM SP,GP1/2,BM&HL	2700.000	77.40	208989.29
0045	402-3190		TN	RECYL AC 19 MM SP,GP 1 OR 2 ,INC BM&HL	1400.000	84.67	118549.23
0049	407-0010		LF	ASPH-RUB JOINT/CRACK SEAL TP M	500.000	1.14	572.16
0050	413-0750		GL	TACK COAT	1200.000	3.00	3600.00
0055	433-1000		SY	REINF CONC APPROACH SLAB	210.000	169.49	35593.59
0060	432-0208		SY	MILL ASPH CONC PVMT/ 2 DEP	8292.000	4.00	33168.00
0065	446-1100		LF	PVMT REF FAB STRIPS, TP2,18 INCH WIDTH	1500.000	6.48	9732.12
0070	441-0754		SY	CONC MEDIAN, 7 1/2 IN	66.000	70.17	4631.22
0075	441-0104		SY	CONC SIDEWALK, 4 IN	2019.000	23.56	47571.96
0080	441-6022		LF	CONC CURB & GUTTER, 6X30TP2	3819.000	15.36	58662.36
0084	445-0500		LF	WATERPROOFING PVMT JTS & CRACK 1 FT	500.000	2.00	1000.00
0085	634-1200		EA	RIGHT OF WAY MARKERS	21.000	123.76	2598.97
0090	641-1100		LF	GUARDRAIL, TP T	36.000	83.11	2992.06
0095	641-1200		LF	GUARDRAIL, TP W	400.000	18.87	7548.67
0100	641-5001		EA	GUARDRAIL ANCHORAGE, TP 1	2.000	970.58	1941.17
0105	641-5012		EA	GUARDRAIL ANCHORAGE, TP 12	2.000	2444.75	4889.52
0110	643-8200		LF	BARRIER FENCE (ORANGE), 4 FT	1570.000	1.42	2243.06
0115	550-1180		LF	STM DR PIPE 18,H 1-10	544.000	48.25	26249.93
0120	550-4218		EA	FLARED END SECT 18 IN, ST DR	5.000	632.73	3163.67
0125	668-1100		EA	CATCH BASIN, GP 1	7.000	2376.46	16635.26
0130	668-2100		EA	DROP INLET, GP 1	2.000	2051.10	4102.21
0134	999-3155		LF	DRY SWALE EDGE DRAIN	100.000	69.36	6936.44
0135	163-0232		AC	TEMPORARY GRASSING	2.000	540.88	1081.77
0140	163-0240		TN	MULCH	128.000	238.89	30578.71
0145	163-0300		EA	CONSTRUCTION EXIT	2.000	1336.92	2673.85
0149	163-0550		EA	CONS & REM INLET SEDIMENT TRAP	10.000	152.14	1521.43
0150	165-0030		LF	MAINT OF TEMP SILT FENCE, TP C	2565.000	1.45	3719.97
0155	165-0101		EA	MAINT OF CONST EXIT	2.000	570.22	1140.45
0159	165-0105		EA	MAINT OF INLET SEDIMENT TRAP	10.000	54.72	547.24
0160	167-1000		EA	WATER QUALITY MONITORING AND SAMPLING	2.000	225.02	450.05
0165	167-1500		MO	WATER QUALITY INSPECTIONS	24.000	587.37	14096.98
0170	171-0030		LF	TEMPORARY SILT FENCE, TYPE C	5130.000	3.45	17733.95
0175	700-6910		AC	PERMANENT GRASSING	3.000	933.08	2799.26

JOB ESTIMATE REPORT

0180	700-7000	TN	AGRICULTURAL LIME	9.000	150.20	1351.88
0185	700-8000	TN	FERTILIZER MIXED GRADE	3.000	583.36	1750.10
0190	700-8100	LB	FERTILIZER NITROGEN CONTENT	144.000	3.23	465.97
0195	700-9300	SY	SOD	5144.000	4.86	25033.79
0200	711-0100	SY	TURF REINFORCING MATTING, TP 1	1840.000	2.50	4600.00
0205	716-2000	SY	EROSION CONTROL MATS, SLOPES	3010.000	1.22	3697.33
0210	636-1041	SF	HWY SIGNS,TP 2MAT,REFL SH TP 9	300.000	37.04	11114.26
0215	636-2070	LF	GALV STEEL POSTS, TP 7	400.000	8.02	3210.86
0218	652-0094	EA	PVMT MARKING, SYMBOL, TP 4	2.000	96.77	193.56
0219	653-0110	EA	THERM PVMT MARK, ARROW, TP 1	2.000	74.13	148.27
0220	653-0120	EA	THERM PVMT MARK, ARROW, TP 2	26.000	84.07	2185.86
0225	653-0130	EA	THERM PVMT MARK, ARROW, TP 3	1.000	118.03	118.03
0230	653-1501	LF	THERMO SOLID TRAF ST 5 IN, WHI	5450.000	0.56	3062.14
0235	653-1502	LF	THERMO SOLID TRAF ST, 5 IN YEL	3930.000	0.56	2229.69
0240	653-1704	LF	THERM SOLID TRAF STRIPE,24,WH	128.000	6.75	864.41
0245	653-1804	LF	THERM SOLID TRAF STRIPE, 8,WH	1665.000	2.13	3562.68
0250	653-3501	GLF	THERMO SKIP TRAF ST, 5 IN, WHI	650.000	0.37	244.00
0255	653-6004	SY	THERM TRAF STRIPING, WHITE	122.000	4.62	563.70
0259	653-6006	SY	THERM TRAF STRIPING, YELLOW	731.000	3.90	2852.67
0260	654-1001	EA	RAISED PVMT MARKERS TP 1	55.000	5.08	279.50
0265	654-1003	EA	RAISED PVMT MARKERS TP 3	72.000	4.53	326.56
0270	657-1085	LF	PRF PL SD PVT MKG,8,B/W,TP PB	400.000	7.34	2936.01
0275	657-6085	LF	PRF PL SD PVMT MKG,8,B/Y,TPPB	800.000	6.82	5461.38
0280	639-4004	EA	STRAIN POLE, TP IV	4.000	7963.30	31853.20
0285	647-1000	LS	TRAF SIGNAL INSTALLATION NO - 1	1.000	60000.00	60000.00
0290	540-1101	LS	REM OF EX BR, STA NO - 23+80	1.000	29900.00	29900.00
0295	543-9000	LS	CONSTR OF BRIDGE COMPLETE - 1	1.000	761100.00	761100.00

ITEM TOTAL	2604747.97
INFLATED ITEM TOTAL	2604747.97

TOTALS FOR JOB 132986

ESTIMATED COST:	2604747.97
CONTINGENCY PERCENT (0.0):	0.00
ESTIMATED TOTAL:	2604747.97

PROJ. NO.		CALL NO.
P.I. NO.	132986	
DATE	4/20/2016	

INDEX (TYPE)	DATE	INDEX
REG. UNLEADED	Apr-16	$ 2.037
DIESEL		$ 2.120
LIQUID AC		$ 336.00

Link to Fuel and AC Index:
http://www.dot.ga.gov/doingbusiness/Materials/Pages/asphaltcementindex.aspx

LIQUID AC ADJUSTMENTS

PA=[((APM-APL)/APL)]xTMTxAPL

Asphalt

Price Adjustment (PA)			**62496**	**$ 62,496.00**
Monthly Asphalt Cement Price month placed (APM)	Max. Cap	60%	$ 537.60	
Monthly Asphalt Cement Price month project let (APL)			$ 336.00	
Total Monthly Tonnage of asphalt cement (TMT)			310	

ASPHALT	Tons	%AC	AC ton
Leveling	1000	5.0%	50
12.5 OGFC		5.0%	0
12.5 mm	1100	5.0%	55
9.5 mm SP		5.0%	0
25 mm SP	2700	5.0%	135
19 mm SP	1400	5.0%	70
	6200		**310**

BITUMINOUS TACK COAT

Price Adjustment (PA)			**$ 1,039.07**	**$ 1,039.07**
Monthly Asphalt Cement Price month placed (APM)	Max. Cap	60%	$ 537.60	
Monthly Asphalt Cement Price month project let (APL)			$ 336.00	
Total Monthly Tonnage of asphalt cement (TMT)			5.154121106	

Bitum Tack Gals	gals/ton	tons
1200	232.8234	5.15412111

PROJ. NO.					CALL NO.		
P.I. NO.	132986						
DATE	4/20/2016						

BITUMINOUS TACK COAT (surface treatment)

Price Adjustment (PA)				**0**	**$ -**
Monthly Asphalt Cement Price month placed (APM)	Max. Cap	60%	$	537.60	
Monthly Asphalt Cement Price month project let (APL)			$	336.00	
Total Monthly Tonnage of asphalt cement (TMT)				0	

Bitum Tack	SY	Gals/SY	Gals	gals/ton	tons
Single Surf. Trmt.		0.20	0	232.8234	0
Double Surf.Trmt.		0.44	0	232.8234	0
Triple Surf. Trmt		0.71	0	232.8234	0
					0

TOTAL LIQUID AC ADJUSTMENT	**$**	**63,535.07**

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

INTERDEPARTMENT CORRESPONDENCE

FILE P.I. No. **132986**

OFFICE Office of Program Delivery

PROJECT DESCRIPTION

SR 120/Duluth Highway @ Singleton Creek 1.5 Mi E of Duluth

DATE April 20, 2016

From: Albert Shelby, PE, State Program Delivery Engineer

To: Lisa L. Myers, State Project Review Engineer
via Email Mailbox: **CostEstimatesandUpdates@dot.ga.gov**

Subject: REVISIONS TO PROGRAMMED COSTS

PROJECT MANAGER: Anthony Tate

MGMT LET DATE: Jun-19

MGMT ROW DATE: Jun-18

PROGRAMMED COSTS (TPro W/OUT INFLATION)			**LAST ESTIMATE UPDATE**	
CONSTRUCTION	**$**	3,388,357.72	DATE	2014
RIGHT OF WAY	**$**	214,731.65	DATE	2005
UTILITIES	**$**		DATE	

REVISED COST ESTIMATES

CONSTRUCTION*	**$**	3,072,018.98
RIGHT OF WAY	**$**	492,000.00
UTILITIES	**$**	928,500.00

*Cost Contains **10** % Contingency

REASONS FOR COST INCREASE AND CONTINGENCY JUSTIFICATION:

Cost adjustments are due to update of the project concept report. Contigency of 10% is based on the allowable range for a Bridge Replacement from the Risk Based Cost Estimation memo dated 4/30/2014

CONTINGENCY SUMMARY

A.	**CONSTRUCTION COST ESTIMATE:**	$ 2,604,747.97	Base Estimate From CES		
B.	**ENGINEERING AND INSPECTION (E & I):**	$ 130,237.40	Base Estimate (A) x	**5**	%
C.	**CONTINGENCY:**	$ 273,498.54	Base Estimate (A) + E & I (B) x	**10**	%
			See % Table in "Risk Based Cost Estimation" Memo		
D.	**TOTAL LIQUID AC ADJUSTMENT:**	$ 63,535.07	Total From Liquid AC Spreadsheet		
E.	**CONSTRUCTION TOTAL:**	$ **3,072,018.98**	(A + B + C + D = E)		

REIMBURSABLE UTILTY COSTS

UTILITY OWNER	REIMBURSABLE COST
GCDWR W&S	$ 300,250.00
GPC - Distribution	$ 411,500.00
Jackson EMC	$ 216,750.00
TOTAL	**$ 928,500.00**

ATTACHMENTS: (File Copy in the Project Cost Estimate Folder)

Detailed Cost Estimate Printout From TRAQS
Liquid AC Adjustment Spreadsheet

GEORGIA DEPARTMENT OF TRANSPORTATION
PRELIMINARY ROW COST ESTIMATE SUMMARY

Date: 1/14/2016 Project: BRSTO-0189-01(030)
Revised: County: Gwinnett
PI: 132986
Description: SR 120/Duluth Highway@ Singleton Creek
Project Termini: SR 120/Duluth Highway@ Singleton Creek
Existing ROW: Varies
Parcels: 10 Required ROW: Varies

Land and Improvements		$262,500.00
Proximity Damage	*$0.00*	
Consequential Damage	*$0.00*	
Cost to Cures	*$0.00*	
Trade Fixtures	*$0.00*	
Improvements	*$55,000.00*	
Valuation Services		$37,500.00
Legal Services		$81,750.00
Relocation		$20,000.00
Demolition		$0.00
Administrative		$90,000.00
TOTAL ESTIMATED COSTS		$491,750.00
TOTAL ESTIMATED COSTS (ROUNDED)		***$492,000.00***

Preparation Credits	Hours	Signature

Prepared By: Dathone Alexander CG#: 286999 01/14/2016 (DATE)
Approved By: Dathone Alexander CG#: 286999 01/14/2016 (DATE)

NOTE: No Market Appreciation is included in this Preliminary Cost Estimate

DEPARTMENT OF TRANSPORTATION
STATE OF GEORGIA

INTERDEPARTMENT CORRESPONDENCE

FILE BRST0-0189-01(030), Gwinnett Co
PI No. 132986-
SR 120/Duluth Hwy @ Singleton Creek 1.5 Miles E of Duluth

OFFICE GAINESVILLE

FROM Robby Oliver, Distr. Utilities Eng.

DATE January 27, 2016

TO Albert Shelby, P.E., State Program Delivery Engineer
ATTN Anthony Tate, Project Manager

SUBJECT PRELIMINARY UTILITY COST ESTIMATE

As requested by your office we are furnishing you with an Preliminary Utility Cost estimate for the subject project.

FACILITY OWNER		NON-REIMBURSABLE		REIMBURSABLE
Atlanta Gas Light		$295,550		$0
AT&T Telephone - Local		$386,550		$0
AT&T Long Distance		$8,400		$0
GCDWR W & S	**	$192,300		$300,250
GPC - Distribution		$0		$411,500
Jackson EMC		$0		$216,750
Charter Communications		$10,050		$0
Comcast CATV		$18,750		$0
Level 3 - Communications		$11,400		$0
Zayo Telecom		$8,400		$0
TOTALS		**$931,400**		**$928,500**

Total Non-Reimbursable Cost **$931,400**

Total Reimbursable Cost **$928,500**

** If the local gov't is granted utility aid, $192,300 will need to be added to the reimbursable cost.

If you have any questions, please contact Robby Oliver at 770-531-5772.

RBO/jlp

cc: Lee Upkins, State Utilities Engineer
Scott Frederick, Area Engineer
File

WETLANDS AND OPEN WATERS
MITIGATION WORKSHEETS
Gwinnett County P.I. 132986
Replacement of the SR 120 Bridge over Singleton Creek

ADVERSE IMPACT FACTORS

Factor	Options						
Dominant Effect	Fill 2.0	Dredge 1.8	Impound 1.6	Drain 1.4	Flood 1.2	Clear 1.0	Shade 0.5
Duration of Effects	7+ years 2.0	5-7 years 1.5	3-5 years 1.0	1-3 years 0.5	< 1 year 0.1		
Existing Condition	Class 1 2.0	Class 2 1.5	Class 3 1.0	Class 4 0.5	Class 5 0.1		
Lost Kind	Kind A 2.0	Kind B 1.5	Kind C 1.0	Kind D 0.5	Kind E 0.1		
Preventability	High 2.0	Moderate 1.0	Low 0.5	None 0			
Rarity Ranking	Rare 2.0	Uncommon 0.5	Common 0.1				

† These factors are determined on a case-by-case basis.

REQUIRED MITIGATION CREDITS WORKSHEET

Factor	WL 4 (fill)					
Dominant Effect	2.0					
Duration of Effect	2.0					
Existing Condition	1.0					
Lost Kind	1.5					
Preventability	0.5					
Rarity Ranking	0.1					
Sum of r Factors	R_1 = 7.1	R_2 =	R_3 =	R_4 =	R_5 =	R_6 =
Impacted Area	AA_1 = 0.20	AA_2 =	AA_3 =	AA_4 =	AA_5 =	AA_6 =
R × AA =	1.42					

Total Required Credits = $\sum$ (R × AA) = **1.42**

For our SR 53 project in Forsyth & Hall Counties, P.I. 0007021, the price per wetland credit was estimated at $34,000. Using this number as the basis for estimating the cost for Section 404 mitigation for this project, the total cost for mitigation would be approximately $48,280.

Crash Summaries

The project area is primarily comprised of two intersections, and most of the crashes occurred at those intersections. Two crashes occurred mid-block, one of which was a run-off the road crash and the other of which was a sideswipe.

Table 1 through Table 4 show the crash statistics of the project area.

Table 1: Crashes by PDO/Injury/Fatal

Year	Property Damage Only	Injury	Fatal	Grand Total
2011	3	4	0	**7**
2012	7	4	0	**11**
2013	5	2	0	**7**
2014	16	3	0	**19**
2015	12	4	0	**16**
Grand Total	**43**	**17**	**0**	**60**

Table 2: Crashes by Intersection

Year	Northmont Parkway	Staunton Drive	Not at an Intersection	Grand Total
2011	4	3		**7**
2012	10	1		**11**
2013	3	4		**7**
2014	11	8		**19**
2015	14		2	**16**
Grand Total	**42**	**16**	**2**	**60**

Table 3: Crashes by Manner of Collision

Year	Angle	Head On	Not A Collision with Motor Vehicle	Rear End	Sideswipe-Opposite Direction	Sideswipe-Same Direction	Grand Total
2011	2		1	4			**7**
2012	2		1	7		1	**11**
2013	1	2	1	3			**7**
2014	2	1	2	13	1		**19**
2015	3		1	11		1	**16**
Grand Total	**10**	**3**	**6**	**38**	**1**	**2**	**60**

Table 4: Crashes by First Harmful Event

Year	Deer	Guard Rail End	Guard Rail Face	Motor Vehicle In Motion	Grand Total
2011	1			6	**7**
2012				11	**11**
2013		1	1	5	**7**
2014		1	1	17	**19**
2015	1			15	**16**
Grand Total	**2**	**2**	**2**	**54**	**60**

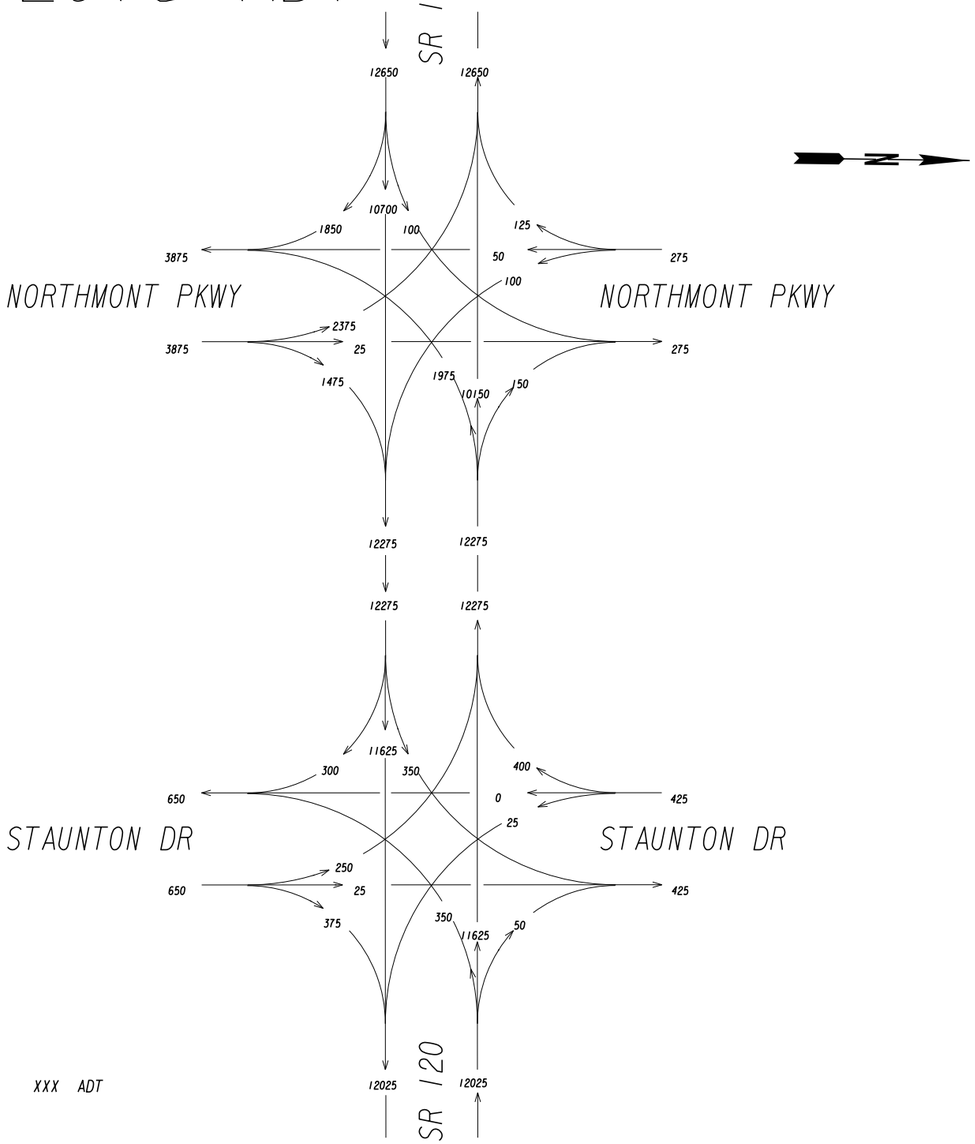
The crash history for this project does not illustrate any particular hot spot or egregious mode of collision that need to be addressed, compared to other similar locations.

Table 5: Crashes at Staunton Drive

Year	Angle	Head On	Not A Collision with Motor Vehicle	Rear End	
2011	1		1	1	**3**
2012	1				**1**
2013	1	1	1	1	**4**
2014	2	1	1	4	**8**
2015					**0**
Grand Total	**5**	**2**	**3**	**6**	**16**

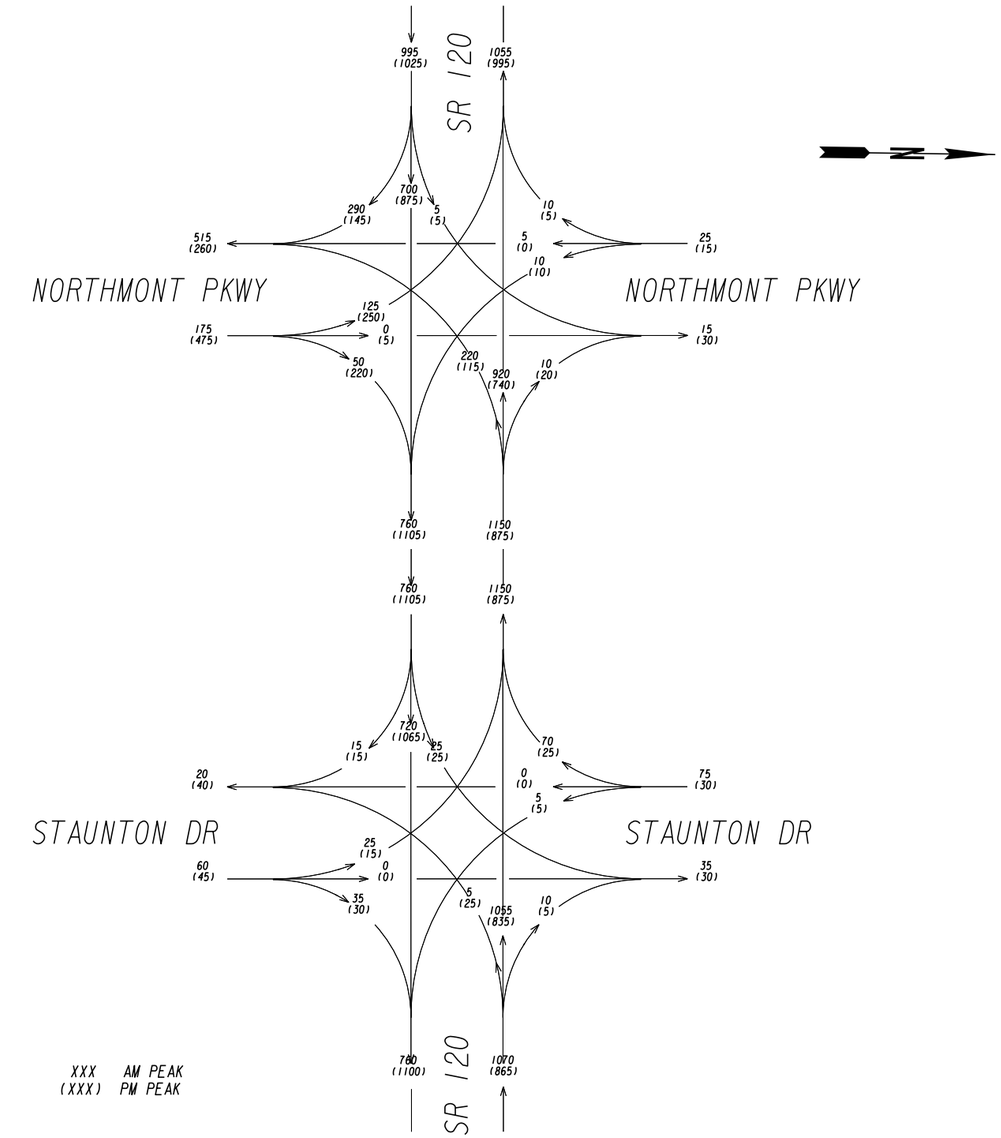
Given the short nature of this project (0.35 miles), crash rate calculations were not conducted.

2015 ADT



Daily Trucks		
Single Unit	Combination	Total
7.0%	1.0%	8.0%

2015 PEAK HOUR



Peak Hour Trucks		
Single Unit	Combination	Total
8.0%	1.0%	9.0%

PI 0132986
GWINNETT COUNTY
AUGUST 11, 2015
WMR/KMC

Michael Baker
INTERNATIONAL
3595 ENGINEERING DRIVE
NORCROSS, GEORGIA 30092
(770) 263-9118

GEORGIA
DEPARTMENT OF TRANSPORTATION

REVISION DATES

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE:

TRAFFIC DIAGRAM

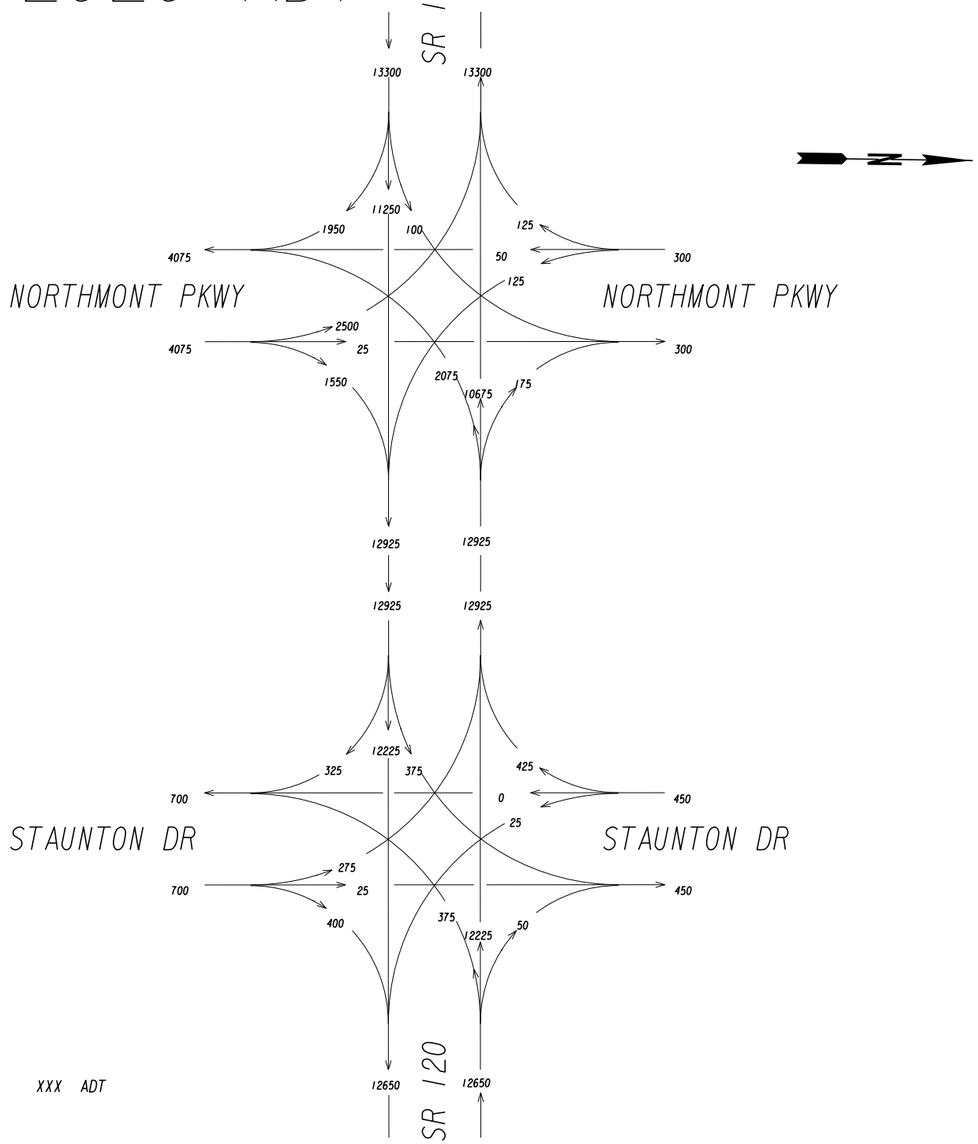
SR 120 AT SINGLETON CREEK

DRAWING No. 10-001

01/26/2015 GPLN

12-AUG-2015 11:04	11:04:34 AM	132986-TRDG1	Y:\Roadways\146615\132986\DGN\132986-TRDG.dgn	STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
bill.ruhsam		GDOT_11x17.pen		GA	P.I. 132986	2	5

2020 ADT

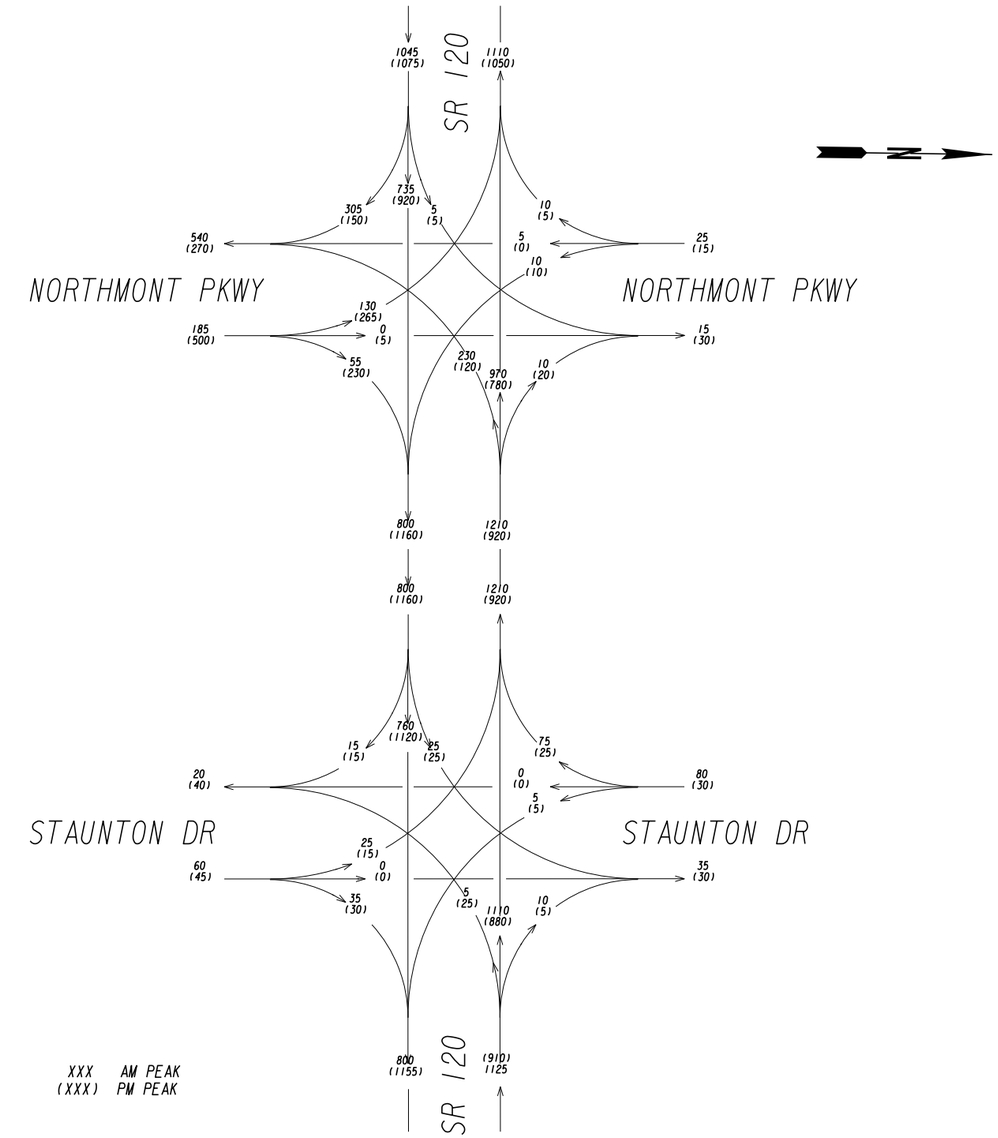


XXX ADT

Daily Trucks		
Single Unit	Combination	Total
7.0%	1.0%	8.0%

BUILD TRAFFIC IS THE SAME AS NO BUILD

2020 DESIGN HOUR



XXX AM PEAK
(XXX) PM PEAK

Peak Hour Trucks		
Single Unit	Combination	Total
8.0%	1.0%	9.0%

BUILD TRAFFIC IS THE SAME AS NO BUILD

PI 0132986
GWINNETT COUNTY
AUGUST 11, 2015
WMR/KMC

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GEORGIA
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REVISION DATES

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE:

TRAFFIC DIAGRAM

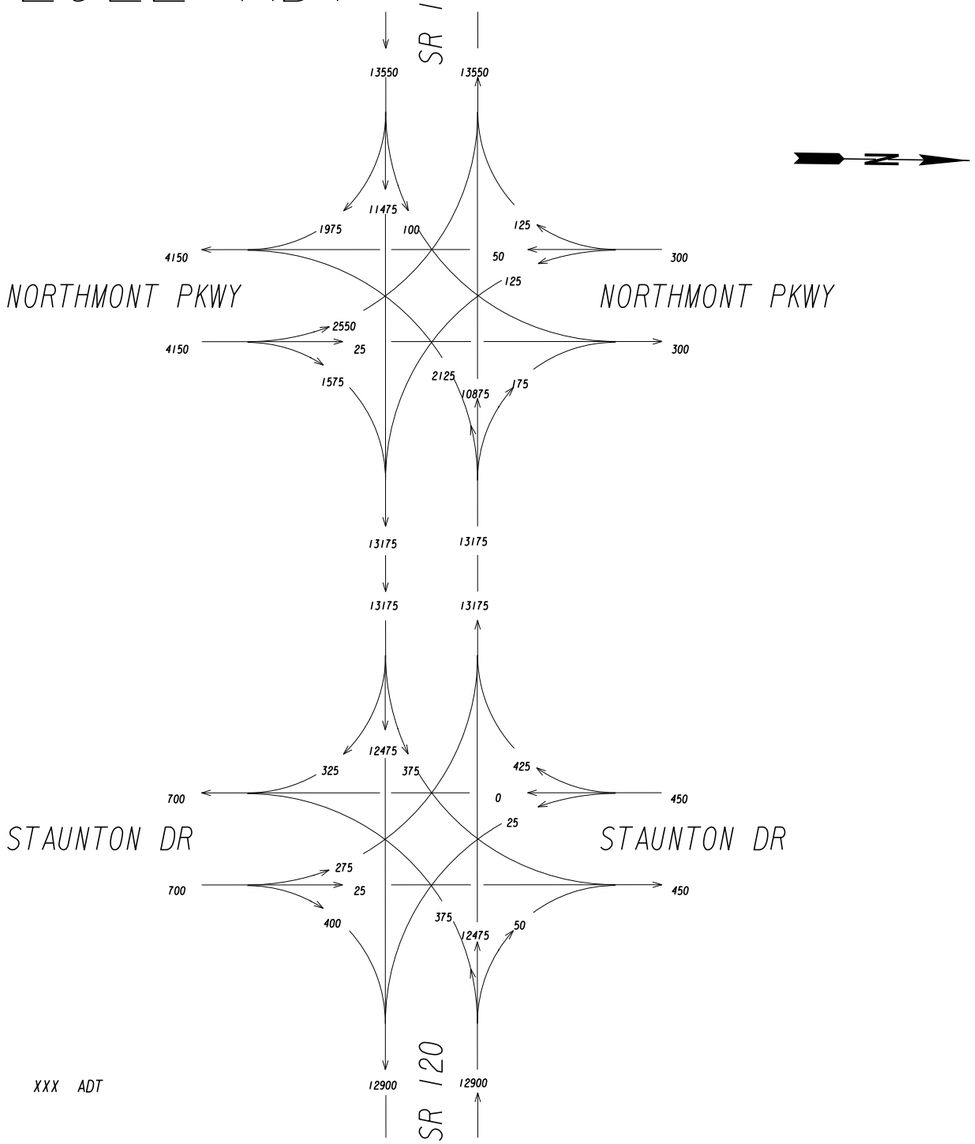
SR 120 AT SINGLETON CREEK

DRAWING No. 10-002

01/26/2015 GPLN

STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
GA	P.I. 132986		

2022 ADT

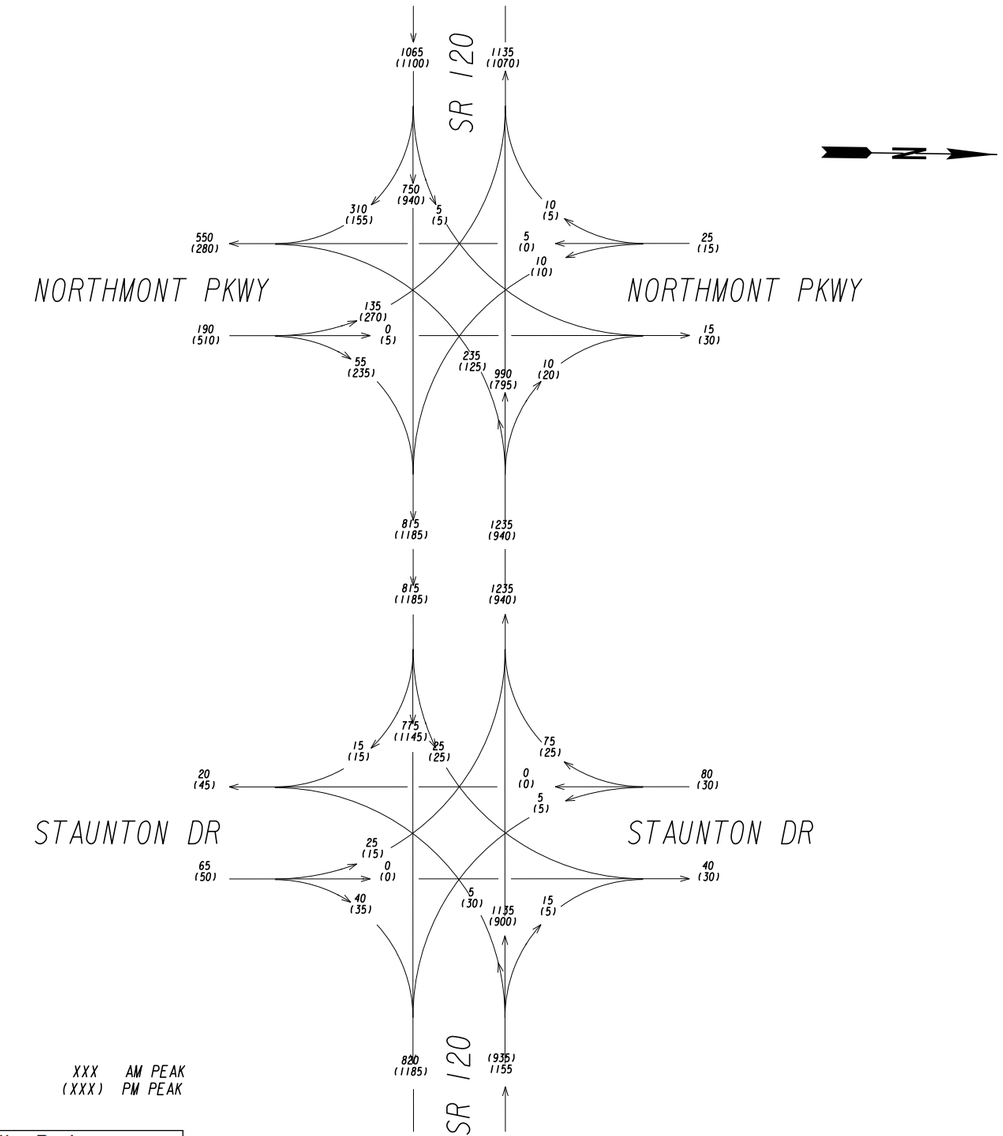


XXX ADT

Daily Trucks		
Single Unit	Combination	Total
7.0%	1.0%	8.0%

BUILD TRAFFIC IS THE SAME AS NO BUILD

2022 DESIGN HOUR



XXX AM PEAK
(XXX) PM PEAK

Peak Hour Trucks		
Single Unit	Combination	Total
8.0%	1.0%	9.0%

BUILD TRAFFIC IS THE SAME AS NO BUILD

PI 0132986
GWINNETT COUNTY
AUGUST 11, 2015
WMR/KMC

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STATE OF GEORGIA
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OFFICE:

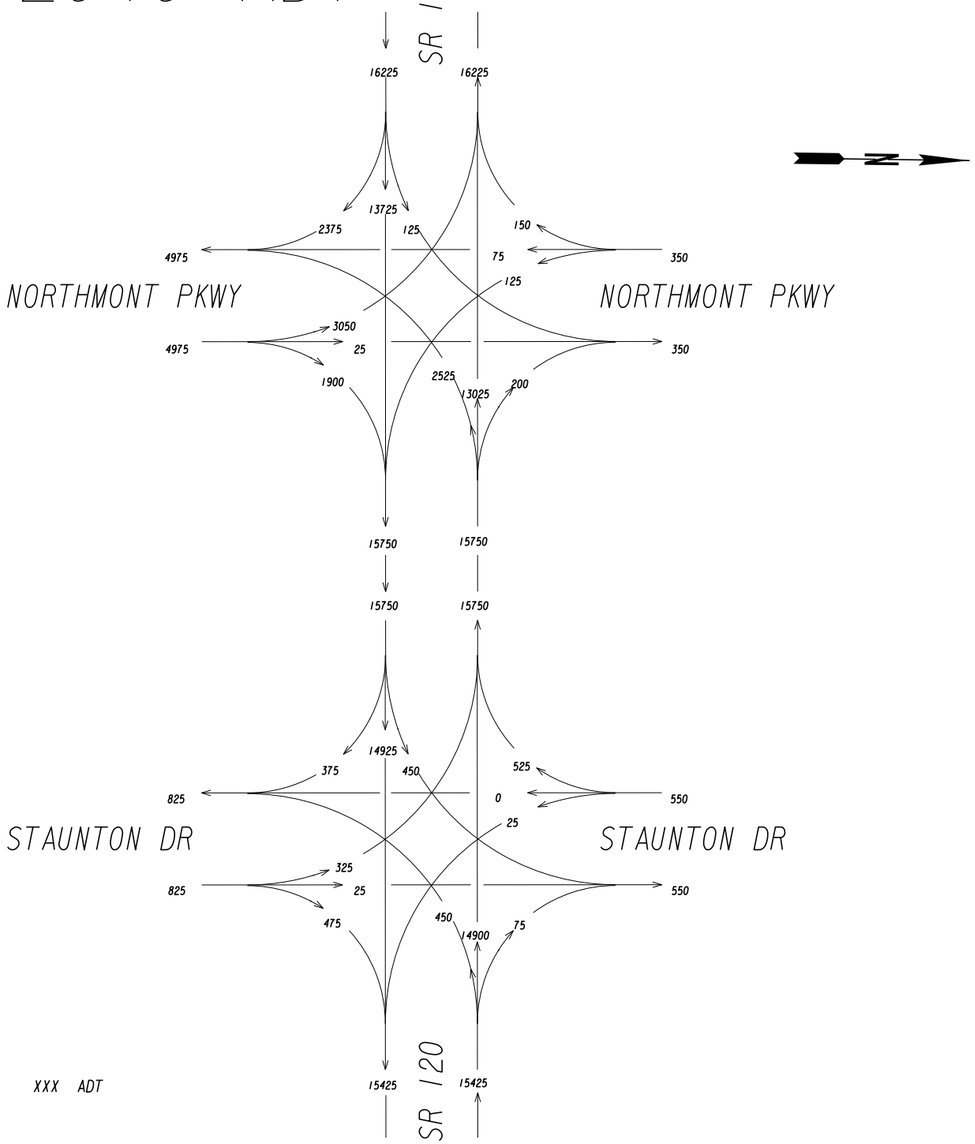
TRAFFIC DIAGRAM

SR 120 AT SINGLETON CREEK

DRAWING No. 10-003

01/26/2015 GPLN

2040 ADT

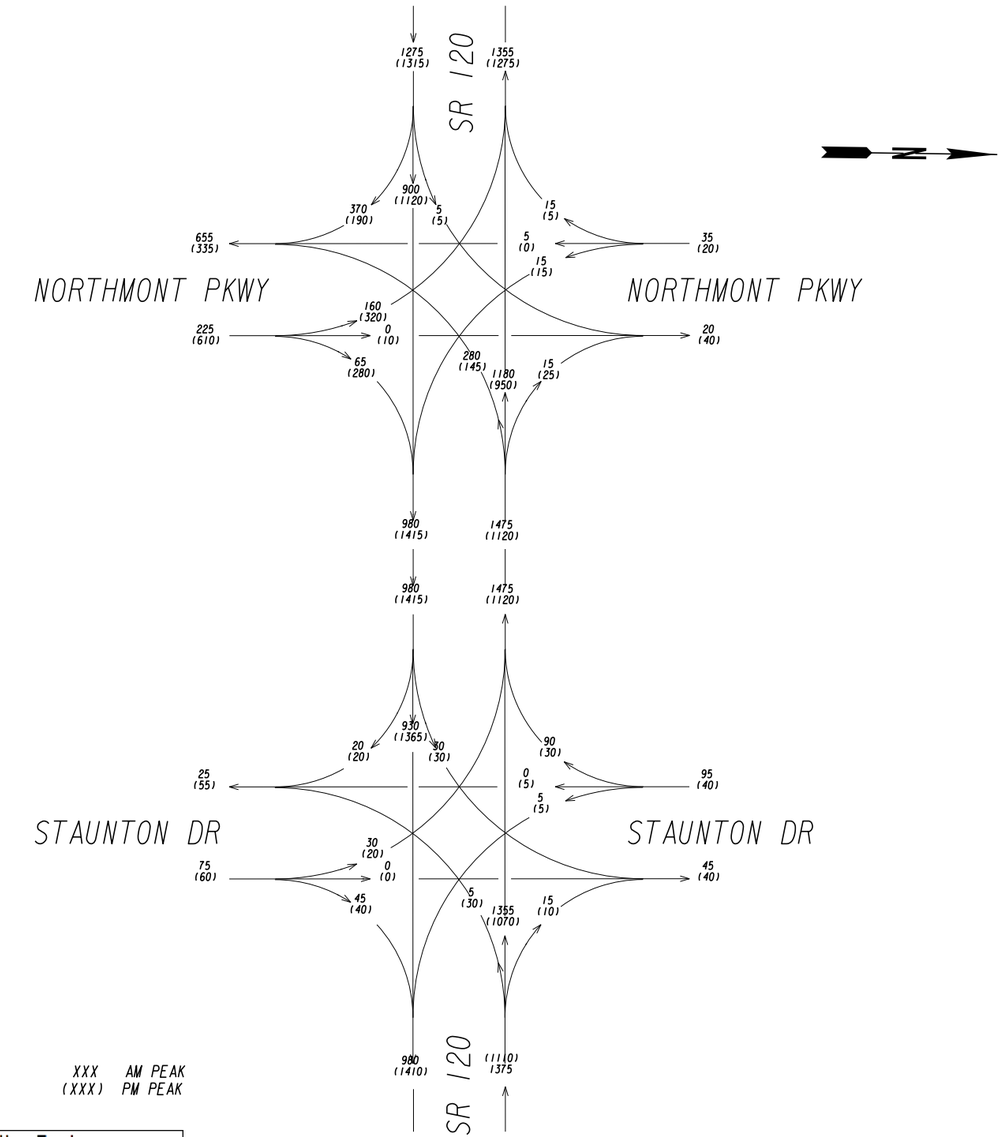


XXX ADT

Daily Trucks		
Single Unit	Combination	Total
7.0%	1.0%	8.0%

BUILD TRAFFIC IS THE SAME AS NO BUILD

2040 DESIGN HOUR



XXX AM PEAK
(XXX) PM PEAK

Peak Hour Trucks		
Single Unit	Combination	Total
8.0%	1.0%	9.0%

BUILD TRAFFIC IS THE SAME AS NO BUILD

PI 0132986
GWINNETT COUNTY
AUGUST 11, 2015
WMR/KMC

01/26/2015 GPLN

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GEORGIA
DEPARTMENT OF TRANSPORTATION

REVISION DATES

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE:

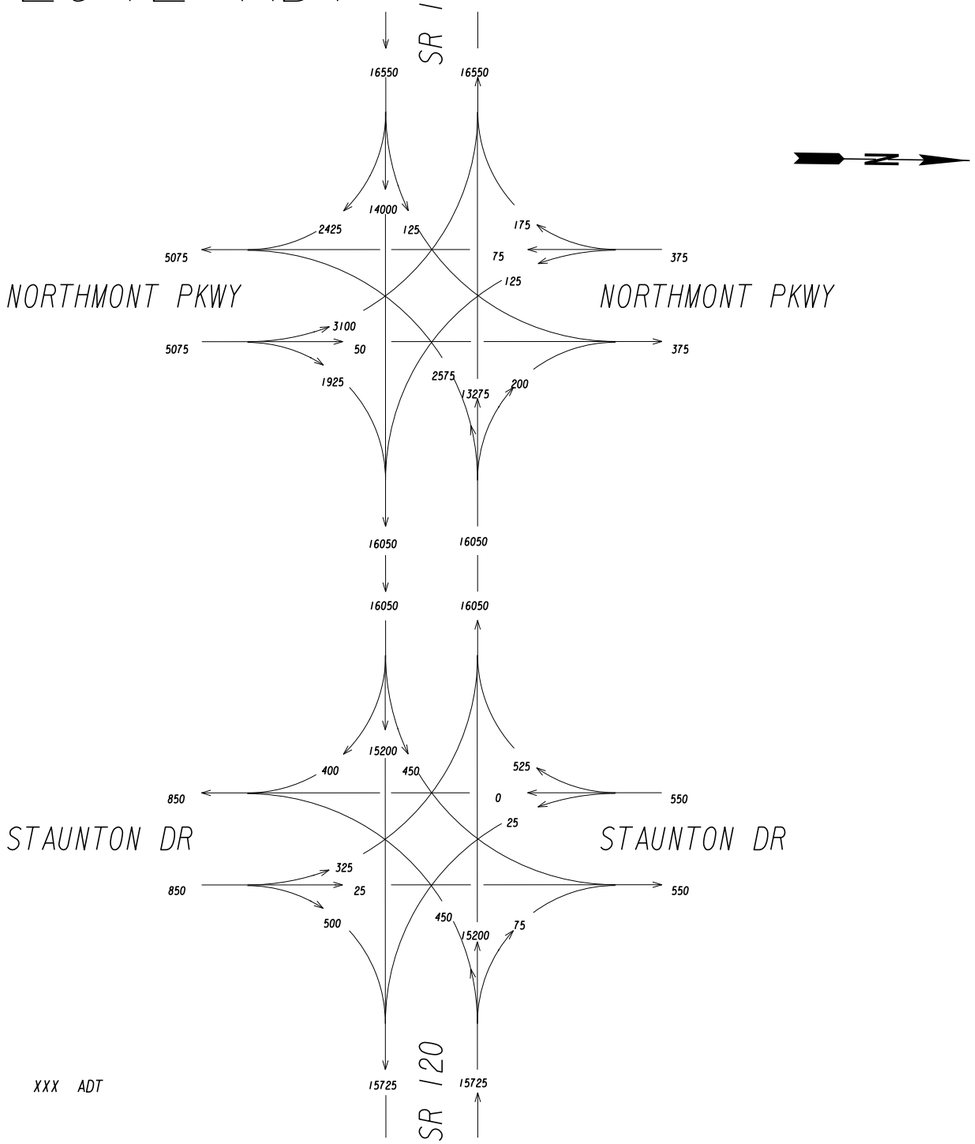
TRAFFIC DIAGRAM

SR 120 AT SINGLETON CREEK

DRAWING No. 10-004

12-AUG-2015 11:02	11:02:10 AM	132986-TRDG4	Y:\Roadways\146615\132986\DGN\132986-TRDG.dgn	STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
bill.ruhsam		GDOT_11x17.pen		GA	P.I. 132986		

2042 ADT

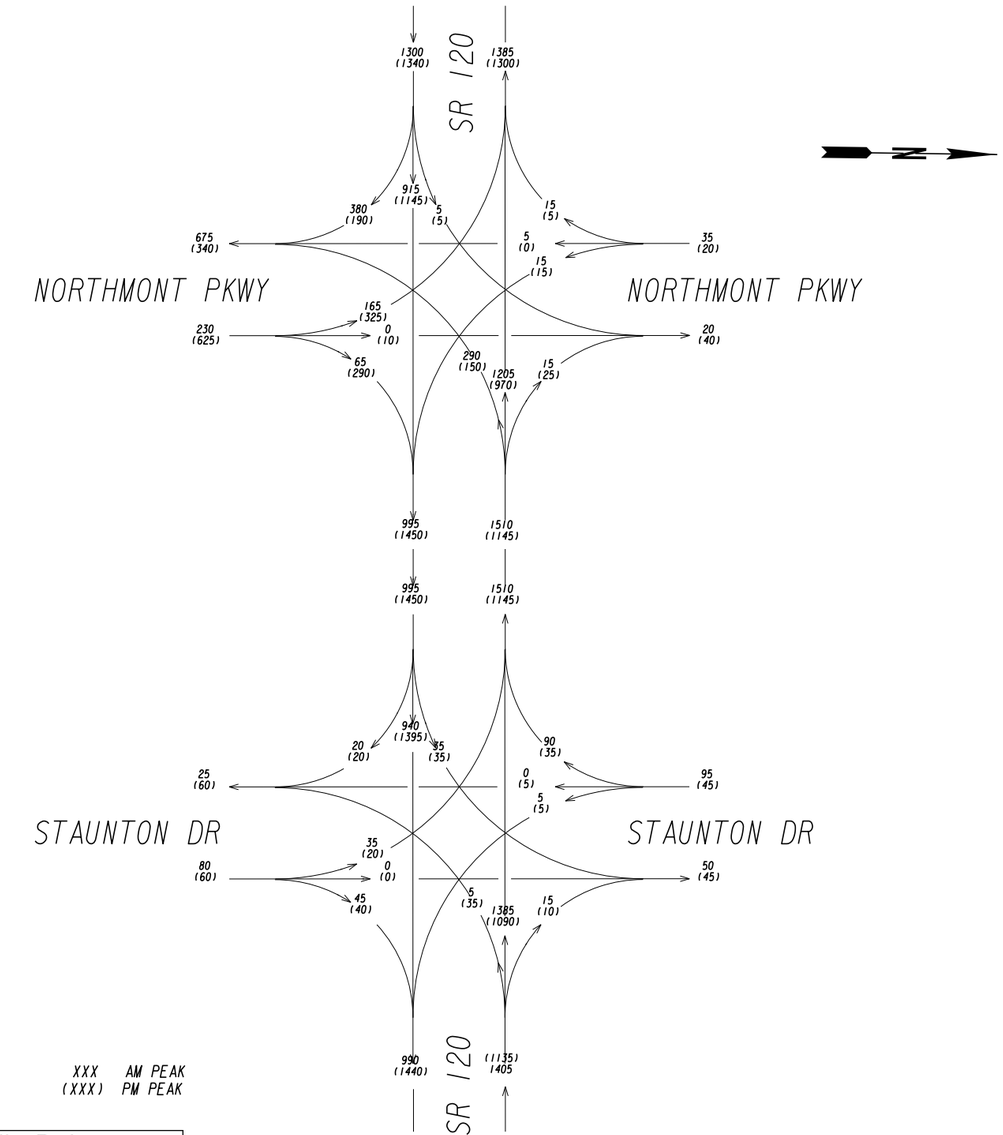


XXX ADT

Daily Trucks		
Single Unit	Combination	Total
7.0%	1.0%	8.0%

BUILD TRAFFIC IS THE SAME AS NO BUILD

2042 DESIGN HOUR



XXX AM PEAK
(XXX) PM PEAK

Peak Hour Trucks		
Single Unit	Combination	Total
8.0%	1.0%	9.0%

BUILD TRAFFIC IS THE SAME AS NO BUILD

PI 0132986
GWINNETT COUNTY
AUGUST 11, 2015
WMR/KMC

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GEORGIA
DEPARTMENT OF TRANSPORTATION

REVISION DATES

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE:

TRAFFIC DIAGRAM

SR 120 AT SINGLETON CREEK

DRAWING No. 10-005

01/26/2015 GPLN

Capacity Analysis

Using the existing geometry, traffic volumes and existing signal timing Existing Conditions *Synchro* models were set up for the study area. The resulting Existing Levels of Service (LOS) for each intersection, for each peak hour, are shown in Table 1. The *Synchro* reports are contained in Appendix B.

Table 1: Existing Intersection LOS

	2015 Existing Level of Service			
	AM Peak		PM Peak	
	Delay (Sec/Veh)	LOS	Delay (Sec/Veh)	LOS
SR 120 at Northmont Pkwy. (Signalized)	19.1	B	17.9	B
SR 120 at Staunton Dr. (Two-Way Stop Control)	*	F	*	F

** On two-way stop controlled analysis, a delay in excess of 999 seconds is reported as unmeasurable.*

The existing operating conditions of Northmont Parkway at SR 120 are good and require no changes. Staunton Drive is showing high delays for the cross street, however a large delay for a low volume stop-controlled approach during only the peak hours does not necessarily justify improvements.

Open Year 2020 and Design Year 2040 volumes were then used to create No Build *Synchro* models with the existing roadway geometry and traffic control, with cycle lengths preserved. The resulting No Build LOS for each intersection, during each peak hour, are presented in Table 2. The *Synchro* reports are contained in Appendix B.

Table 2: No Build Intersection LOS

	No Build Level of Service (delay in sec/veh)							
	Open Year 2020				Design Year 2040			
	AM Peak		PM Peak		AM Peak		PM Peak	
	Delay (Sec/ Veh)	LOS	Delay (Sec/ Veh)	LOS	Delay (Sec/ Veh)	LOS	Delay (Sec/ Veh)	LOS
SR 120 at Northmont Pkwy. (Signalized)	20.7	C	45.1	D	44.4	D	88.7	F
SR 120 at Staunton Dr. (Two-Way Stop Control)	*	F	*	F	*	F	*	F

** On two-way stop controlled analysis, a delay in excess of 999 seconds is reported as unmeasurable.*

In 2020, the LOS at Northmont Parkway will by C and D in the AM and PM, respectively, still acceptable Levels of Service for an urban area. In 2040, Northmont Parkway will fall to LOS F in the PM peak hour without any change to the operating conditions.

Build Conditions *Synchro* models were developed to evaluate the intersection operations with the proposed geometry. The resulting Build LOS for each intersection, during each peak hour of both the Open Year 2020 and Design Year 2040, are shown in Table 3. The Synchro reports are contained in Appendix B.

Table 3: Build Intersection LOS

	Build Level of Service (delay in sec/veh)							
	Open Year 2020				Design Year 2040			
	AM Peak		PM Peak		AM Peak		PM Peak	
	Delay (Sec/ Veh)	LOS	Delay (Sec/ Veh)	LOS	Delay (Sec/ Veh)	LOS	Delay (Sec/ Veh)	LOS
SR 120 at Northmont Pkwy. (Signalized)	21.4	C	39.2	D	44.7	D	76.6	E
SR 120 at Staunton Dr. (Two-Way Stop Control)	*	F	*	F	*	F	*	F

** On two-way stop controlled analysis, a delay in excess of 999 seconds is reported as unmeasurable.*

As shown above, in the Open Year 2020 there is a slight increase in delay at Northmont Parkway during the AM peak hour and a slight reduction in the PM peak hour. Neither LOS changes from the No-Build condition.

In the Design Year 2040 the AM peak hour delay is nearly identical to the No-Build, however the proposed improvements change the LOS during the PM peak hour from F to E, still considered a failing LOS in an urban area.

The *Synchro* model for 2040 PM peak hour was modified to investigate what changes would be required to achieve a LOS D. In order to achieve that acceptable level of service, both the northbound and westbound left turns would need to be expanded to dual lefts. Constructing dual lefts on either, but not both, of those turns would still have LOS E, with a delay of approximately 65 seconds per vehicle. As this project does not contain provisions for extensive widening that would be required to provide receiving lanes for dual lefts, this is not recommended.

Michael Baker INTERNATIONAL

MEMORANDUM

TO: Ben Clopper, P.E.

FROM: Bill Ruhsam, P.E., PTOE

SUBJECT: SR 120 at Singleton Creek Traffic Study
PI 132988

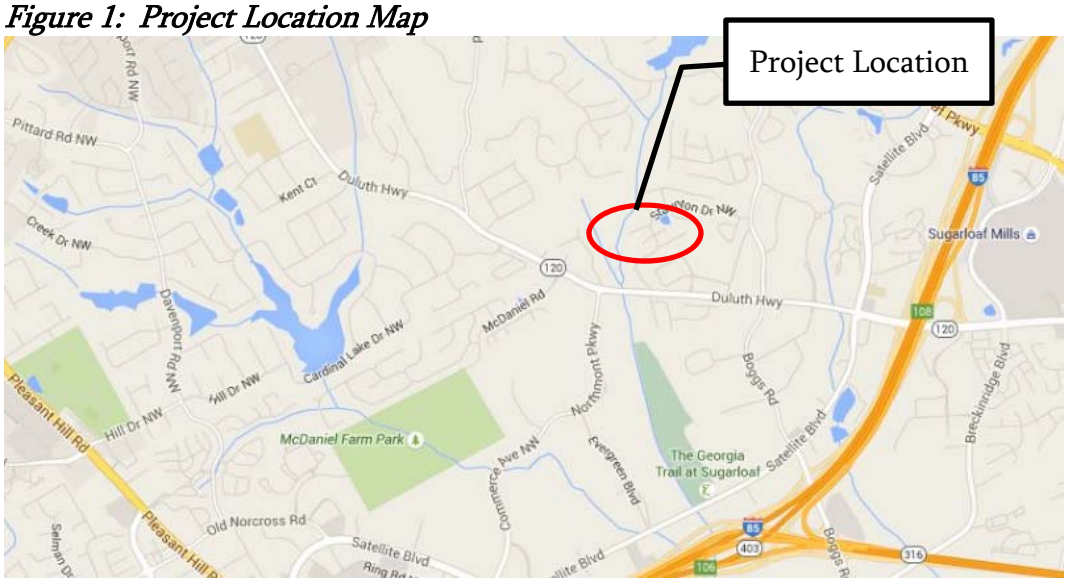
DATE: October 23, 2015

This memo documents the analysis conducted by Michael Baker International (Baker) regarding the SR 120 at Singleton Creek bridge replacement project. This memo summarizes the analysis of approved traffic volumes under the proposed Build conditions. For a description of how traffic volumes were derived, see the Traffic Projections Summary Memorandum included in the appendix.

Project Location and Scope

The project is located on SR 120 (Duluth Highway) between Northmont Parkway and Staunton Drive. The project location is shown in Figure 1.

Figure 1: Project Location Map



The project consists of replacement of the existing SR 120 bridge over Singleton Creek. The total project length is 0.35 miles The project is located in Gwinnett County, 1.2 miles

east of the City of Duluth. The new bridge will include two 12' lanes plus a center turn lane, shoulders and a sidewalk for pedestrians.

As a part of the project, intersection improvements are proposed for SR 120 at Northmont Parkway and and SR 120 at Staunton Drive. The existing condition of each intersection is shown in Figure 2 and Figure 3.

Figure 2: SR 120 at Northmont Parkway Existing Conditions

Figure 3: SR 120 at Staunton Drive Existing Conditions

The proposed conditions for these intersections are to address operational deficiencies identified by this traffic study, but within a limited scope, i.e. no additional widening. With the limitation of no additional capacity, possible improvements include changes to

turn lane storage and signal phasing. Table 1 shows the existing and proposed turn lane conditions.

Table 1: Turn Lane Storage; Existing and Proposed

		Existing/No Build		Proposed	
		Northmont Parkway	Staunton Drive	Northmont Parkway	Staunton Drive
Eastbound	Left	240	175	200	220
	Right	220	285	250	220
Westbound	Left	95	300	450	300
	Right	210	205	250	205
Eastbound	Left	260	Shared Lane	260	Shared Lane
	Right	Lane Drop	Shared Lane	Lane Drop	Shared Lane
Westbound	Left	65	Shared Lane	65	Shared Lane
	Right	Shared Lane	Shared Lane	Shared Lane	Shared Lane

Crash Summaries

The project area is primarily comprised of two intersections, and most of the crashes occurred at those intersections. Two crashes occurred mid-block, one of which was a run-off the road crash and the other of which was a sideswipe.

Table 2 through Table 5 show the crash statistics of the project area.

Table 2: Crashes by PDO/Injury/Fatal

Year	Property Damage Only	Injury	Fatal	Grand Total
2011	3	4	0	**7**
2012	7	4	0	**11**
2013	5	2	0	**7**
2014	16	3	0	**19**
2015	12	4	0	**16**
Grand Total	**43**	**17**	**0**	**60**

Table 3: Crashes by Intersection

Year	Northmont Parkway	Staunton Drive	Not at an Intersection	Grand Total
2011	4	3		**7**
2012	10	1		**11**
2013	3	4		**7**
2014	11	8		**19**
2015	14		2	**16**
Grand Total	**42**	**16**	**2**	**60**

Table 4: Crashes by Manner of Collision

Year	Angle	Head On	Not A Collision with Motor Vehicle	Rear End	Sideswipe-Opposite Direction	Sideswipe-Same Direction	Grand Total
2011	2		1	4			**7**
2012	2		1	7		1	**11**
2013	1	2	1	3			**7**
2014	2	1	2	13	1		**19**
2015	3		1	11		1	**16**
Grand Total	**10**	**3**	**6**	**38**	**1**	**2**	**60**

Table 5: Crashes by First Harmful Event

Year	Deer	Guard Rail End	Guard Rail Face	Motor Vehicle In Motion	Grand Total
2011	1			6	**7**
2012				11	**11**
2013		1	1	5	**7**
2014		1	1	17	**19**
2015	1			15	**16**
Grand Total	**2**	**2**	**2**	**54**	**60**

The crash history for this project does not illustrate any particular hot spot or egregious mode of collision that need to be addressed, compared to other similar locations.

Table 6: Crashes at Staunton Drive

Year	Angle	Head On	Not A Collision with Motor Vehicle	Rear End	
2011	1		1	1	**3**
2012	1				**1**
2013	1	1	1	1	**4**
2014	2	1	1	4	**8**
2015					**0**
Grand Total	**5**	**2**	**3**	**6**	**16**

Given the short nature of this project (0.35 miles), crash rate calculations were not conducted.

Signal Warrants

The existing signalized intersection at Northmont Parkway will be maintained, with a change to signal phasing to optimize the intersection. The northbound left turn warrants protected/permitted left turn phasing in addition to the existing protected/permitted left turn for westbound lefts from SR 120.

The possibility of a signal at Staunton Drive was evaluated using the conditions set forth in the Manual on Uniform Traffic Control Devices. The 2009 edition of the Manual on Uniform Traffic Control Devices (MUTCD) states that an engineering study shall be conducted to justify the installation of a traffic control signal. The study shall investigate the need for a traffic control signal based on an analysis of the applicable traffic signal warrants, as listed below:

Warrant 1 – Eight-Hour Vehicular Volume
Warrant 2 – Four-Hour Vehicular Volume
Warrant 3 – Peak Hour
Warrant 4 – Pedestrian Volume
Warrant 5 – School Crossing
Warrant 6 – Coordinated Signal System
Warrant 7 – Crash Experience
Warrant 8 – Roadway Network
Warrant 9 – Intersection Near a Grade Crossing

The MUTCD also provides guidance that while a traffic signal should not be installed unless one or more of these warrants is met, meeting a warrant or warrants does not in itself require the installation of a traffic control signal. In all cases, engineering judgment should be used to determine if the installation of a traffic control signal will improve the overall safety and/or operation of the intersection.

Each of the applicable warrants listed above were evaluated for the intersection of Staunton Drive at SR 120.

Warrant 1 – Eight-Hour Vehicular Volume

Warrant 1 is composed of two conditions, Condition A – Minimum Vehicular Volume and Condition B – Interruption of Continuous Traffic. The MUTCD states that the need for a traffic control signal shall be considered if one of the two conditions of the warrant exists for 8 hours of an average day. The required volumes from the MUTCD, as well as the traffic volumes for the study intersection, are presented in Table 7: Warrant 1 – Eight-Hour Vehicular Volume

Table 7: Warrant 1 – Eight-Hour Vehicular Volume

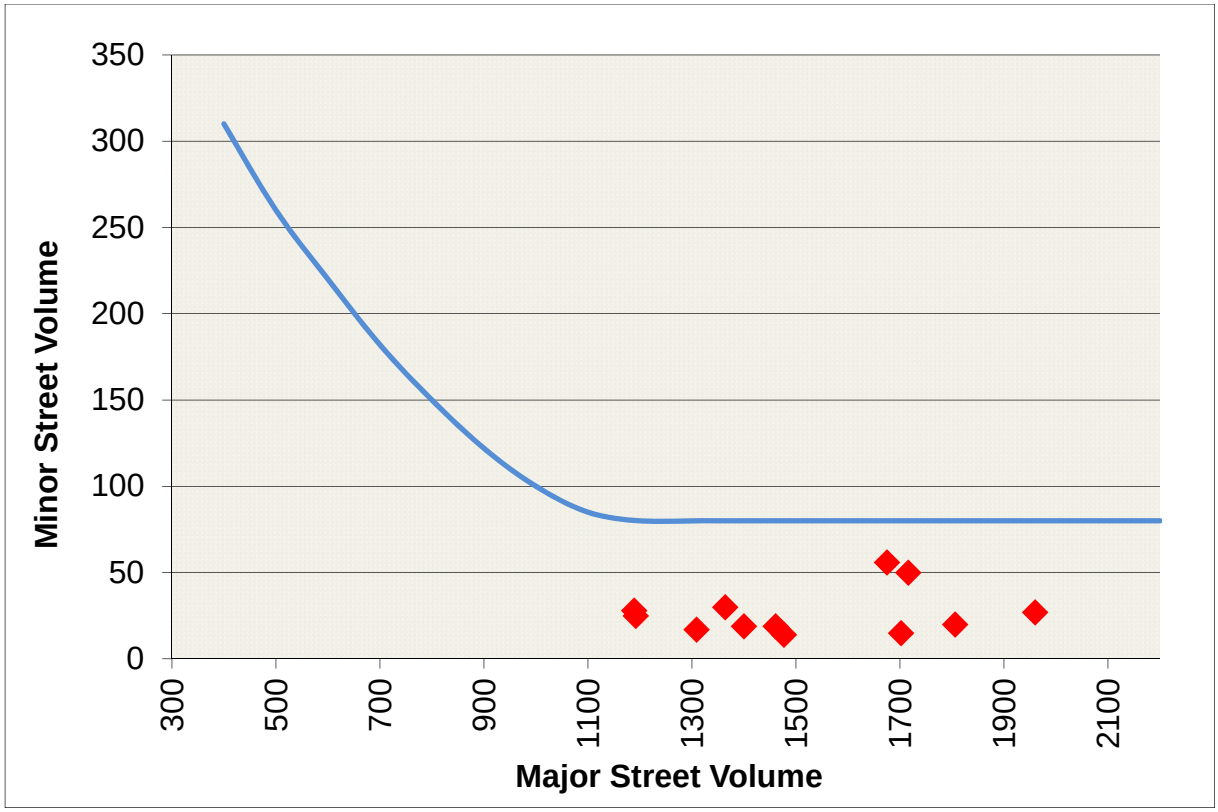
Hour	Traffic Volume		Condition A Satisfied ?		Condition B Satisfied ?	
	Major Approach	Minor Approach	Major Approach	Minor Approach	Major Approach	Minor Approach
			(500)	(150)	(750)	(75)
12-1 AM	143	2	NO	NO	NO	NO
1-2 AM	67	0	NO	NO	NO	NO
2-3 AM	56	0	NO	NO	NO	NO
3-4 AM	57	1	NO	NO	NO	NO
4-5 AM	128	2	NO	NO	NO	NO
5-6 AM	402	12	NO	NO	NO	NO
6-7 AM	1164	11	YES	NO	YES	NO
7-8 AM	1675	56	YES	NO	YES	NO
8-9 AM	1716	50	YES	NO	YES	NO
9-10 AM	1364	30	YES	NO	YES	NO
10-11 AM	1189	28	YES	NO	YES	NO
11-12 Noon	1192	25	YES	NO	YES	NO
12-1 PM	1400	19	YES	NO	YES	NO
1-2 PM	1309	17	YES	NO	YES	NO
2-3 PM	1477	14	YES	NO	YES	NO
3-4 PM	1461	19	YES	NO	YES	NO
4-5 PM	1702	15	YES	NO	YES	NO
5-6 PM	1960	27	YES	NO	YES	NO
6-7 PM	1806	20	YES	NO	YES	NO
7-8 PM	1416	27	YES	NO	YES	NO
8-9 PM	996	15	YES	NO	YES	NO
9-10 PM	874	21	YES	NO	YES	NO
10-11 PM	487	4	NO	NO	NO	NO
11-12 Midnight	284	2	NO	NO	NO	NO

The necessary volumes for Condition A are met for zero hours and Condition B are met for zero hours. **Therefore, Warrant 1 is Not Satisfied.**

Warrant 2 – Four-Hour Vehicular Volume

According to the MUTCD, the conditions of Warrant 2 are to be applied where the volume of intersecting traffic is the principal reason to consider installing a traffic control signal. To satisfy Warrant 2, the hourly vehicular volume of each of four hours in an average day must fall above the applicable curve, as provided in the MUTCD. The curve for 1-or-more-lanes & 1-lane is shown in Table 8, on which points for each hour of traffic volume have been plotted.

Table 8: Warrant 2 - Four Hour Vehicular Warrants



A total of zero points, each representing one hour of vehicular volume, lie above the applicable curve. **Therefore, Warrant 2 is Not Satisfied.**

Warrant 3 – Peak Hour

The study intersection is not an unusual case such as an office complex, manufacturing plant or HOV parking facility, as described in the MUTCD. Therefore, Warrant 3 in not applicable.

Warrant 4 – Pedestrian Volume

Pedestrian delay crossing the street was not observed at the time this report was written. Therefore, Warrant 4 is not applicable.

Warrant 5 – School Crossing

The presence of schoolchildren crossing the major street is not the principal reason to consider installing a traffic control signal at this intersection. Therefore, Warrant 5 is not applicable.

Warrant 6 – Coordinated Signal System

Maintaining progressive movement in a coordinated signal system is not a factor in considering the installation of a traffic control signal at this intersection. Therefore, Warrant 6 is not applicable.

Warrant 7 – Crash Experience

The MUTCD states that the need for a traffic control signal shall be considered if all three of the following criteria are met for an intersection.

A. Adequate trial of alternatives with satisfactory observance and enforcement
B. Five or more reported crashes, of types susceptible to correction by a traffic control signal, have occurred in a 12-month period
C. For each of any 8 hours of an average day, the vehicles per hour (vph) given in both of the 80 percent columns of Warrant 1, Condition A, or the vph in both of the 80 percent columns of Warrant 1, Condition B exists on the major-street and the higher-volume minor-street approach

Crash statistics for the area were gathered from the GEARS website. In the period 2012-2015 (to date) only one twelve-month period had five or more crashes (2014) but only two of those would be addressable by a signal installation (angle-type crashes). **Therefore, Warrant 7 is Not Satisfied.**

Warrant 8 – Roadway Network

Encouraging concentration and organization of traffic flow is not the motive for installing a traffic control signal at this intersection. Therefore, Warrant 8 is not applicable.

Warrant 9 – Intersection Near a Grade Crossing

The study intersection is not located in close proximity to a grade crossing. Therefore, Warrant 9 is not applicable.

A summary of the nine traffic signal warrants, as presented in the MUTCD are show in Table 9.

Table 9: Signal Warrant Summary

WARRANT	SR 120 at Staunton Drive
1. Eight-Hour Vehicular Volume	Not Satisfied
2. Four-Hour Vehicular Volume	Not Satisfied
3. Peak Hour	Not Applicable
4. Pedestrian Volume	Not Applicable
5. School Crossing	Not Applicable
6. Coordinated Signal System	Not Applicable
7. Crash Experience	Not Satisfied
8. Roadway Network	Not Applicable
9. Intersection Near a Grade Crossing	Not Applicable

Capacity Analysis

Using the existing geometry, traffic volumes and existing signal timing Existing Conditions *Synchro* models were set up for the study area. The resulting Existing Levels of Service (LOS) for each intersection, for each peak hour, are shown in Table 10. The *Synchro* reports are contained in Appendix B.

Table 10: Existing Intersection LOS

	2015 Existing Level of Service			
	AM Peak		PM Peak	
	Delay (Sec/Veh)	LOS	Delay (Sec/Veh)	LOS
SR 120 at Northmont Pkwy. (Signalized)	19.1	B	17.9	B
SR 120 at Staunton Dr. (Two-Way Stop Control)	*	F	*	F

** On two-way stop controlled analysis, a delay in excess of 999 seconds is reported as unmeasurable.*

The existing operating conditions of Northmont Parkway at SR 120 are good and require no changes. Staunton Drive is showing high delays for the cross street, however a large delay for a low volume stop-controlled approach during only the peak hours does not necessarily justify improvements.

Open Year 2020 and Design Year 2040 volumes were then used to create No Build *Synchro* models with the existing roadway geometry and traffic control, with cycle lengths preserved. The resulting No Build LOS for each intersection, during each peak hour, are presented in Table 11. The *Synchro* reports are contained in Appendix B.

Table 11: No Build Intersection LOS

	No Build Level of Service (delay in sec/veh)							
	Open Year 2020				Design Year 2040			
	AM Peak		PM Peak		AM Peak		PM Peak	
	Delay (Sec/ Veh)	LOS	Delay (Sec/ Veh)	LOS	Delay (Sec/ Veh)	LOS	Delay (Sec/ Veh)	LOS
SR 120 at Northmont Pkwy. (Signalized)	20.7	C	45.1	D	44.4	D	88.7	F
SR 120 at Staunton Dr. (Two-Way Stop Control)	*	F	*	F	*	F	*	F

** On two-way stop controlled analysis, a delay in excess of 999 seconds is reported as unmeasurable.*

In 2020, the LOS at Northmont Parkway will by C and D in the AM and PM, respectively, still acceptable Levels of Service for an urban area. In 2040, Northmont Parkway will fall to LOS F in the PM peak hour without any change to the operating conditions.

Build Conditions *Synchro* models were developed to evaluate the intersection operations with the proposed geometry. The resulting Build LOS for each intersection, during each peak hour of both the Open Year 2020 and Design Year 2040, are shown in Table 12. The Synchro reports are contained in Appendix B.

Table 12: Build Intersection LOS

	Build Level of Service (delay in sec/veh)							
	Open Year 2020				Design Year 2040			
	AM Peak		PM Peak		AM Peak		PM Peak	
	Delay (Sec/ Veh)	LOS	Delay (Sec/ Veh)	LOS	Delay (Sec/ Veh)	LOS	Delay (Sec/ Veh)	LOS
SR 120 at Northmont Pkwy. (Signalized)	21.4	C	39.2	D	44.7	D	76.6	E
SR 120 at Staunton Dr. (Two-Way Stop Control)	*	F	*	F	*	F	*	F

** On two-way stop controlled analysis, a delay in excess of 999 seconds is reported as unmeasurable.*

As shown above, in the Open Year 2020 there is a slight increase in delay at Northmont Parkway during the AM peak hour and a slight reduction in the PM peak hour. Neither LOS changes from the No-Build condition.

In the Design Year 2040 the AM peak hour delay is nearly identical to the No-Build, however the proposed improvements change the LOS during the PM peak hour from F to E, still considered a failing LOS in an urban area.

The *Synchro* model for 2040 PM peak hour was modified to investigate what changes would be required to achieve a LOS D. In order to achieve that acceptable level of service, both the northbound and westbound left turns would need to be expanded to dual lefts. Constructing dual lefts on either, but not both, of those turns would still have LOS E, with a delay of approximately 65 seconds per vehicle. As this project does not contain provisions for extensive widening that would be required to provide receiving lanes for dual lefts, this is not recommended.

Roundabout Feasibility

The project scope is for a bridge replacement and does not contemplate capacity improvements at either studied intersections. A roundabout was not considered at Northmont Parkway as this type of improvement is beyond the scope of this project.

A roundabout was not considered at Staunton due to the ratio of mainline (SR 120) traffic to sidestreet (Staunton Drive) traffic being greater than 90%.

Summary

In summary:

- The proposed improvements at SR 120 at Northmont Parkway maintain an acceptable level of service except in the design year (2040) PM peak hour.
- Improvements to achieve LOS D or better throughout the design year peak hours are beyond the scope of this project.
- Staunton Drive, while experiencing high delays for the side street traffic, only experiences this during the peak hours and does not warrant a traffic signal or roundabout.

Appendix A – GDOT Approved Traffic Volumes

Michael Baker INTERNATIONAL

MEMORANDUM

TO: Abby Ebodaghe
Georgia Department of Transportation
Office of Planning

FROM: William M. Ruhsam, Jr, P.E., PTOE
Kelly M. Cory, P.E., PTOE

SUBJECT: Summary of Design Traffic Projections
SR 120 at Singleton Creek
Gwinnett County, PI# 0132986
Michael Baker International Project # 144615

DATE: August 11, 2015

Context

Traffic projections have been produced for this project following the methods and procedures contained in the Georgia Department of Transportation (GDOT) Design Policy Manual Chapter 13.

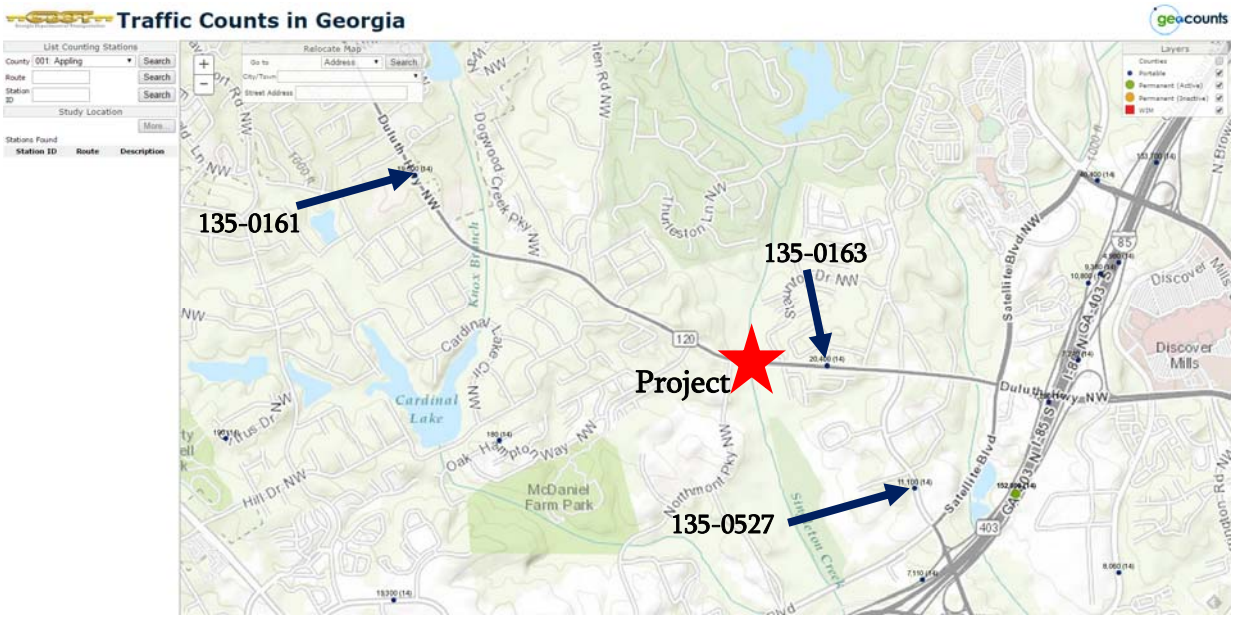
Purpose

This memorandum is written to summarize and provide background information for the design traffic projections subject project. The SR 120 at Singleton Creek project will consist of replacing the existing bridge for SR 120 over Singleton Creek. A concept was developed about 12 years ago that showed replacing the bridge to the south side and it is expected this general layout will be retained. The total project length is 0.4 miles and includes two intersections in addition to the bridge replacement

Study Area

The study area is in the City of Duluth, Gwinnett County. The immediate study area includes SR 120 (Duluth Highway) from Northmount Parkway to Staunton Drive. See Figure 1 for a study area map which includes the relevant local GDOT count stations.

Figure 1: Study Area Map



Source: Google, Inc., Georgia Department of Transportation

Annual Coverage Counts, Travel Demand Model & Growth Rates

GDOT historical annualized average daily traffic (AADT) data was obtained from three (3) traffic count stations in the vicinity of the project. The locations of the stations selected are shown in Figure 1 and the GDOT Traffic Count Database reports for each station are contained in Appendix A.

Using the historical data obtained, the historical growth rates for each station were examined using the least squares method for 5, 10, and 15 years. Discarding data from the count stations that were estimated values, the 10 year[1] annual growth rate was separately calculated. The annual counts are shown in Table 1. The growth rates are shown in Table 2.

[1] In some cases, due to the years with estimated counts, the 10-year actual growth rate is approximated by the 9-year rate. See the table for details of which years are estimated and which are actual.

Table 1: Annual Coverage Counts

Traffic Count Station	135-0161		135-0163		135-0527	
Roadway	SR 120		SR 120		Boggs Road	
Location	Between Buford Hwy and Knox Branch Creek		Between Knox Branch Creek and Satellite Blvd.		Between SR 120 and Satellite Blvd.	
1990	14,510	A	15,012	A	3,065	A
1991	13,983	A	15,775	A	4,738	A
1992	12,623	A	14,263	A	4,696	A
1993	13,100	A	14,200	A	4,800	A
1994	13,800	A	15,600	A	6,000	A
1995	13,900	A	15,700	A	6,200	A
1996	18,800	A	21,500	A	8,100	A
1997	16,500	A	19,200	A	-	-
1998	19,600	A	22,600	A	9,600	E
1999	17,800	E	21,700	E	9,800	E
2000	20,300	E	25,900	E	11,600	E
2001	21,300	E	22,900	A	11,900	E
2002	21,917	E	23,807	E	12,217	E
2003	20,680	A	21,990	A	10,820	A
2004	24,290	A	24,180	A	13,160	A
2005	21,620	A	25,790	A	12,870	A
2006	21,690	A	23,950	A	12,120	A
2007	20,330	A	24,900	E	12,850	E
2008	24,060	A	23,440	E	13,660	A
2009	23,390	E	22,790	E	13,280	E
2010	18,110	A	22,840	E	13,310	E
2011	18,090	E	20,470	A	11,120	A
2012	14,900	A	20,360	E	11,060	E
2013	14,970	E	20,430	A	11,110	E
2014	19,500	A	20,400	E	11,100	E

"A" indicates a count station that was actually counted that calendar year.

"E" indicates a count station that was estimated for that calendar year.

Source: Georgia Department of Transportation

Table 2: Annual Growth Rates

		GDOT Count Station		
		135-0161	135-0163	135-0527
Least Squares Method	15-year	-0.1%	-0.1%	0.0%
	10-year	-0.1%	-0.2%	-0.2%
	5-year	0.0%	-0.1%	-0.1%
Using Actual Counts (As close to 10-year as possible)	Approx. 10-year	-0.5%	-0.7%	0.3%
ARC Travel Demand Model	2015	21,092		1.2%
	2040	28,602	ARC Growth Rate	

Source: Michael Baker International

Within Table 2, all years' data were used for calculation of the Least Squares Method. As the Department prefers to only use actual traffic counts for grown predictions, the approximate ten-year rate[2] was calculated using a constant-rate regression calculation. Using these actual traffic counts, the rate of growth on SR 120 has been negative or zero over the last decade. The growth on Boggs Road has been positive, but low. The Atlanta Regional Commission travel demand model shows a 1.2% annual growth rate. In order to ensure that a conservative analysis is conducted and turn lanes are adequate, a 1.0% annual growth rate was selected for this project.

Traffic Counts

Michael Baker International conducted turning movement counts (TMCs), classification counts, and bi-directional volume counts on all roadways and intersections within the study area of the project. The traffic count location map is shown in Appendix B. All counts were taken while school was in session.

An evaluation of the count data shows that the morning peak hour occurs from 7:30 to 8:30 AM and the afternoon peak hour occurs from 5:00 to 6:00 PM. The count data was further analyzed to determine the K & D factors for the project area roadways, as discussed in the next section.

K & D Analysis

K-values and D-factors for the project area roadways were calculated using the most recent GDOT actual traffic counts and the volume counts collected for this project. A summary of the weighted K-values during each peak hour for the project area is shown below in Table 3.

[2] In only one instance could a 10-year growth evaluation be calculated (TC 135-0163) due to holes in the annual county data. In the other two calculations an 11-year (TC 135-0161) and an 8-year (TC 135-0527) were used.

Table 3: K-Values

	K-Value	
	AM Peak	**PM Peak**
Project Area Weighted Average	0.07	0.07
Mainline Weighted Average	0.08	0.08
Sidestreet Weighted Average	0.06	0.05

Source: Michael Baker International

The sidestreet Ks show weighted values at 0.06 and 0.05 for AM and PM respectively, however the K value is heavily adjusted by volumes on Boggs Road. An excerpt from the K & D worksheet is shown in Table 4. The actual measured K values for the side streets vary from 0.06 to 0.13, and reflect the volatility of low volume roadways. The K values for the sidestreets are reflected in the volume diagrams shown in the Appendix E.

Table 4: Excerpt from K & D Worksheet

					AM	PM	AM	PM
Count #	Year	Daily Traffic	Location Description	Mainline or Sidestreet	Total Hourly Traffic		K Value	
2	2015	532	Northmont Pkwy north of SR 120	S	39	42	0.07	0.08
3	2015	7,744	Northmont Pkwy south of SR 120	S	694	746	0.09	0.10
5	2015	845	Staunton Dr. north of SR 120	S	112	56	0.13	0.07
6	2015	1,302	Staunton Dr. south of SR 120	S	79	87	0.06	0.07
135-0527	2015	24,320	Boggs Rd Between SR 120 and Satellite Blvd.	S	1038	860	0.04	0.04

Source: Michael Baker International

The full K & D worksheet is shown in Appendix C.

Truck Percentages

The truck classification percentages were measured on SR 120 at the east and west ends of the project area. The 24-hour, AM, and PM peak hour truck percentages were averaged across the two days of data gathered for this count. These raw truck percentages are shown along with the selected truck percentages, rounded to a half-percent, in Table 5.

Table 5: Truck Percentages

	SR 120 west of Northmont Pkwy		
	Single Unit	Combination	Total
24-Hour	6.6%	0.5%	7.1%
AM Peak	7.9%	0.5%	8.4%
PM Peak	4.1%	0.4%	4.4%
SR 120 east of Staunton Dr			
24-Hour	6.9%	0.8%	7.8%
AM Peak	7.7%	0.6%	8.3%
PM Peak	5.3%	0.5%	5.7%
Selected Truck Percentages			
24-Hour	7.0%	1.0%	8.0%
Peak	8.0%	1.0%	9.0%

Source: Michael Baker International, Inc.

Build vs. No Build

Based on the concept plan, there is no anticipated difference in traffic volume between the build and no-build concepts. The capacity of the roadway will not be increased.

Development of Design Traffic

Using the turning movement counts, the bi-directional volume counts, and the K and D values from the K & D worksheet, the 2015 traffic volumes were smoothed and balanced. The smoothed and balanced Peak Hour and Average Daily Traffic were projected to 2020 and 2040 using a 1.0% annual growth rate.

Per direction from the GDOT Office of Planning, two additional sets of traffic diagrams were prepared for years 2022 and 2040.

The design traffic volumes are shown in Appendix E.

List of Appendices

Appendix A: GDOT Count Station Reports

Short Term Station **1350161**
In **Gwinnett** County
Located on **012000**
LRS ID: **1351012000**

Referencing | Annual Statistics | Surveys

About Station 1350161

Station ID	**1350161**	
County	Gwinnett	
City		
Road		
Road functional class	urban - Minor Arterial	
Description		
Routes	Route Number	012000
	Concurrent Route Number	
	Concurrent Route 2	
	Concurrent Route 3	
LRS Section ID	1351012000 @ 0.000 Miles	
Traffic Segment	2.460 to 4.440 Miles	
Coordinate (Lat/Lon)	33.989000, -84.132000	
Map Reference		

Short Term Station **1350161**
In **Gwinnett** County
Located on **012000**
LRS ID: **1351012000**

Referencing | Annual Statistics | Surveys

	Volume		Trucks
2014	19535		
2013	14970		
2012	14900		
2011	18090		
2010	18110		
2009	23390		
2008	24060		
2007	20330		
2006	21690		
2005	21620		
2004	24290		
2003	20680		
2002	21917		
2001	21300		
2000	20300		
1999	17800		
1998	19600		
1997	16500		
1996	18800		
1995	13900		
1994	13800		
1993	13100		
1992	12623		
1991	13983		
1990	14510		

Key Annual Trends

Year	Annual Average Daily Traffic	% APR Change	Annual Average Daily Truck Traffic	% Trucks	K Factor	D Factor	85th Pctl Speed
2014	19535	30.49			8.76	50.00	
2013	14970	0.47					
2012	14900	-17.63					
2011	18090	-0.11					
2010	18110	-22.57					
2009	23390	-2.78					
2008	24060	18.35					
2007	20330	-6.27					
2006	21690	0.32					
2005	21620	-10.99					
2004	24290						

Short Term Station **1350161**
In **Gwinnett** County
Located on **012000**
LRS ID: **1351012000**

Referencing | Annual Statistics | Surveys

Year	Month	Status	Summary	Volume By Hour	Class By Hour	Speed	Turning Movements
2010	May	Count accepted	Summary | By Day	All | North | South			
2012	Mar	Count accepted	Summary | By Day	All | North | South			
2014	Jan	Count accepted	Summary | By Day	All | North | South			

Short Term Station **1350161**
In **Gwinnett** County
Located on **012000**
LRS ID: **1351012000**

Referencing | Annual Statistics | Surveys

Year	Month	Status	Summary	Volume By Hour	Class By Hour	Speed	Turning Movements
2010	May	Count accepted	Summary | By Day	All | North | South			
2012	Mar	Count accepted	Summary | By Day	All | North | South			
2014	Jan	Count accepted	Summary | By Day	All | North | South			

Volume By Hour
Direction: All Directions

Time	Tue Feb 18	Wed Feb 19	Thu Feb 20	Total	Avg	Pct	Graphic
12:00 am		64	74	138	69	0.35	
1:00 am		32	46	78	39	0.20	
2:00 am		44	48	92	46	0.23	
3:00 am		36	40	76	38	0.19	
4:00 am		98	70	168	84	0.42	
5:00 am		260	304	564	282	1.41	
6:00 am		1016	954	1970	985	4.93	
7:00 am		1576	1540	3116	1558	7.79	
8:00 am		1676	1630	3306	1653	8.27	
9:00 am		1236	1240	2476	1238	6.19	
10:00 am		960	858	1818	909	4.55	
11:00 am		918	942	1860	930	4.65	
12:00 pm	1028	1012		2040	1020	5.10	
1:00 pm	1110	1142		2252	1126	5.63	
2:00 pm	1268	1228		2496	1248	6.24	
3:00 pm	1442	1380		2822	1411	7.06	
4:00 pm	1584	1544		3128	1564	7.82	
5:00 pm	1712	1712		3424	1712	8.56	
6:00 pm	1494	1424		2918	1459	7.30	
7:00 pm	1070	1024		2094	1047	5.24	
8:00 pm	638	636		1274	637	3.19	
9:00 pm	428	554		982	491	2.46	
10:00 pm	302	250		552	276	1.38	
11:00 pm	164	188		352	176	0.88	
Total	12240	20010	7746	39996	19998		
SF	1.047	1.047	1.047				
DF	0.931	0.935	0.929				
AADT		19596			19535		

Short Term Station **1350163**
In **Gwinnett** County
Located on **012000**
LRS ID: **1351012000**

Referencing | Annual Statistics | Surveys

About Station 1350163

Station ID	**1350163**	
County	Gwinnett	
City		
Road		
Road functional class	urban - Minor Arterial	
Description		
Routes	Route Number	012000
	Concurrent Route Number	
	Concurrent Route 2	
	Concurrent Route 3	
LRS Section ID	1351012000 @ 0.000 Miles	
Traffic Segment	4.440 to 5.680 Miles	
Coordinate (Lat/Lon)	33.978500, -84.104700	
Map Reference		

Short Term Station **1350163**
In **Gwinnett** County
Located on **012000**
LRS ID: **1351012000**

Referencing | Annual Statistics | Surveys

	Volume		Trucks
2014	20430		
2013	20430		
2012	20360		
2011	20470		
2010	22840		
2009	22790		
2008	23440		
2007	24900		
2006	23950		
2005	25790		
2004	24180		
2003	21990		
2002	23807		
2001	22900		
2000	25900		
1999	21700		
1998	22600		
1997	19200		
1996	21500		
1995	15700		
1994	15600		
1993	14200		
1992	14263		
1991	15775		
1990	15012		

Key Annual Trends

Year	Annual Average Daily Traffic	% APR Change	Annual Average Daily Truck Traffic	% Trucks	K Factor	D Factor	85th Pctl Speed
2014	20430	0.00					
2013	20430	0.34			9.00		
2012	20360	-0.54					
2011	20470	-10.38					
2010	22840	0.22					
2009	22790	-2.77					
2008	23440	-5.86					
2007	24900	3.97					
2006	23950	-7.13					
2005	25790	6.66					
2004	24180						

Short Term Station **1350163**
In **Gwinnett** County
Located on **012000**
LRS ID: **1351012000**

Referencing | Annual Statistics | Surveys

Year	Month	Status	Summary	Volume By Hour	Class By Hour	Speed	Turning Movements
2011	Mar	Count accepted	Summary | By Day	All | North | South			
2013	Mar	Count accepted	Summary | By Day	All | North | South			
2015	Feb	Count accepted	Summary | By Day	All | North | South			

Short Term Station **1350163**
In **Gwinnett** County
Located on **012000**
LRS ID: **1351012000**

Referencing | Annual Statistics | Surveys

Year	Month	Status	Summary	Volume By Hour	Class By Hour	Speed	Turning Movements
2011	Mar	Count accepted	Summary | By Day	All | North | South			
2013	Mar	Count accepted	Summary | By Day	All | North | South			
2015	Feb	Count accepted	Summary | By Day	All | North | South			

Volume By Hour
Direction: All Directions

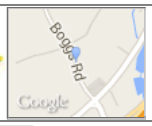
Time	Tue Mar 17	Wed Mar 18	Thu Mar 19	Total	Avg	Pct	Graphic
12:00 am		140	126	266	133	0.57	
1:00 am		70	68	138	69	0.30	
2:00 am		60	66	126	63	0.27	
3:00 am		70	86	156	78	0.33	
4:00 am		128	132	260	130	0.56	
5:00 am		394	344	738	369	1.58	
6:00 am		1158	1052	2210	1105	4.74	
7:00 am		1646	1554	3200	1600	6.86	
8:00 am		1794	1682	3476	1738	7.45	
9:00 am		1480	1386	2866	1433	6.14	
10:00 am		1080	1002	2082	1041	4.46	
11:00 am		1164	1058	2222	1111	4.76	
12:00 pm	1358	1288		2646	1323	5.67	
1:00 pm	1308	1388		2696	1348	5.78	
2:00 pm	1460	1410		2870	1435	6.15	
3:00 pm	1448	1486		2934	1467	6.29	
4:00 pm	1634	1726		3360	1680	7.20	
5:00 pm	1988	1868		3856	1928	8.27	
6:00 pm	1702	1690		3392	1696	7.27	
7:00 pm	1242	1410		2652	1326	5.69	
8:00 pm	894	964		1858	929	3.98	
9:00 pm	636	714		1350	675	2.89	
10:00 pm	406	414		820	410	1.76	
11:00 pm	244	222		466	233	1.00	
Total	14320	23764	8556	46640	23320		
SF	0.000	0.000	0.000				
DF	0.000	0.000	0.000				
AADT		0			0		

Short Term Station **1350527**
In **Gwinnett** County
Located on **055200**
LRS ID: **1352055200**

Referencing | Annual Statistics | Surveys

About Station 1350527

Station ID	**1350527**	
County	Gwinnett	
City		
Road		
Road functional class	urban - Minor Arterial	
Description		
Routes	Route Number	055200
	Concurrent Route Number	
	Concurrent Route 2	
	Concurrent Route 3	
LRS Section ID	1352055200 @ 0.000 Miles	
Traffic Segment	1.300 to 2.220 Miles	
Coordinate (Lat/Lon)	33.971800, -84.098900	
Map Reference		



Short Term Station **1350527**
In **Gwinnett** County
Located on **055200**
LRS ID: **1352055200**

Referencing | Annual Statistics | Surveys

	Volume		Trucks
2014	11100		
2013	11110		
2012	11060		
2011	11120		
2010	13310		
2009	13280		
2008	13660		
2007	12850		
2006	12120		
2005	12870		
2004	13160		
2003	10820		
2002	12217		
2001	11900		
2000	11600		
1999	9800		
1998	9600		
1997	-		
1996	8100		
1995	6200		
1994	6000		
1993	4800		
1992	4696		
1991	4738		
1990	3065		

Key Annual Trends

Year	Annual Average Daily Traffic	% APR Change	Annual Average Daily Truck Traffic	% Trucks	K Factor	D Factor	85th Pctl Speed
2014	11100	-0.09					
2013	11110	0.45					
2012	11060	-0.54					
2011	11120	-16.45					
2010	13310	0.23					
2009	13280	-2.78					
2008	13660	6.30					
2007	12850	6.02					
2006	12120	-5.83					
2005	12870	-2.20					
2004	13160						

Short Term Station **1350527**
In **Gwinnett** County
Located on **055200**
LRS ID: **1352055200**

Referencing | Annual Statistics | Surveys

Year	Month	Status	Summary	Volume By Hour	Class By Hour	Speed	Turning Movements
2011	Mar	Count accepted	Summary | By Day	All | East | West			
2015	Feb	Count accepted	Summary | By Day	All | East | West			

Appendix B: Traffic Count Data

Prepared by National Data & Surveying Services

CLASSIFICATION

SR 120/Duluth Hwy E/O Staunton Dr

Day: Wednesday
Date: 5/13/2015

City: Duluth
Project #: GA15_9189_007

Summary

Time	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	# 10	# 11	# 12	# 13	Total
00:00 AM	0	112	11	1	7	1	0	5	0	0	0	0	0	137
01:00	0	59	3	0	2	0	0	3	0	0	0	0	0	67
02:00	0	42	1	1	2	0	0	2	1	0	0	0	0	49
03:00	0	43	3	1	5	0	0	2	1	0	0	0	0	55
04:00	0	106	13	0	6	0	0	1	1	0	0	0	0	127
05:00	1	332	38	3	30	1	0	3	0	0	0	0	0	408
06:00	5	926	140	5	82	2	0	4	5	0	0	0	0	1169
07:00	3	1354	204	10	121	3	0	4	5	0	0	0	0	1704
08:00	0	1403	159	8	117	3	0	6	6	0	0	0	0	1702
09:00	3	1077	162	2	101	4	0	5	6	0	0	0	0	1360
10:00	0	923	168	8	89	8	0	7	4	0	0	0	0	1207
11:00	4	941	160	7	76	6	1	6	8	0	0	0	0	1209
12:00 PM	7	1072	174	5	108	3	0	7	9	0	0	0	0	1385
13:00	2	1020	170	8	92	3	0	8	8	0	0	0	0	1311
14:00	5	1151	155	7	97	4	0	10	8	0	0	0	0	1437
15:00	2	1131	166	12	114	1	0	7	9	0	0	0	0	1442
16:00	2	1380	185	7	107	1	0	8	5	0	0	0	0	1695
17:00	3	1667	168	4	99	2	0	4	5	0	0	0	0	1952
18:00	4	1476	197	3	85	0	0	4	2	0	0	0	0	1771
19:00	2	1160	131	0	78	1	0	1	0	0	0	0	0	1373
20:00	2	802	86	2	52	0	0	0	1	0	0	0	0	945
21:00	0	727	81	0	39	0	0	1	2	0	0	0	0	850
22:00	0	422	35	0	18	0	0	4	2	0	0	0	0	481
23:00	1	240	20	1	9	0	0	3	1	0	0	0	0	275
Totals	46	19566	2630	95	1536	43	1	105	89					24111
% of Totals	0%	81%	11%	0%	6%	0%	0%	0%	0%					100%

AM Volumes	16	7318	1062	46	638	28	1	48	37	0	0	0	0	9194
% AM	0%	30%	4%	0%	3%	0%	0%	0%	0%					38%
AM Peak Hour	06:00	08:00	07:00	07:00	07:00	10:00	11:00	10:00	11:00					07:00
Volume	5	1403	204	10	121	8	1	7	8					1704
PM Volumes	30	12248	1568	49	898	15	0	57	52	0	0	0	0	14917
% PM	0%	51%	7%	0%	4%	0%		0%	0%					62%
PM Peak Hour	12:00	17:00	18:00	15:00	15:00	14:00		14:00	12:00					17:00
Volume	7	1667	197	12	114	4		10	9					1952

Directional Peak Periods	AM 7-9			NOON 12-2			PM 4-6			Off Peak Volumes		
All Classes	Volume	⟷	%	Volume	⟷	%	Volume	⟷	%	Volume	⟷	%
	3406		14%	2696		11%	3647		15%	14362		60%

Classification Definitions

1 Motorcycles
2 Passenger Cars
3 2-Axle, 4-Tire Single Units
4 Buses
5 2-Axle, 6-Tire Single Units
6 3-Axle Single Units
7 > =4-Axle Single Units
8 <=4-Axle Single Trailers
9 5-Axle Single Trailers
10 >=6-Axle Single Trailers
11 <=5-Axle Multi-Trailers
12 6-Axle Multi-Trailers
13 >=7-Axle Multi-Trailers

Prepared by NDS/ATD

VOLUME

Staunton Dr S/O SR 120/Duluth Hwy

Day: Wednesday
Date: 5/13/2015

City: Duluth
Project #: GA15_9189_006

DAILY TOTALS	NB	SB	EB	WB	Total
	650	652	0	0	1,302

AM Period	NB		SB		EB	WB	TOTAL		PM Period	NB		SB		EB	WB	TOTAL	
00:00	3		6				9		12:00	9		12				21	
00:15	1		1				2		12:15	8		10				18	
00:30	1		3				4		12:30	8		9				17	
00:45	2	7	2	12			4	19	12:45	6	31	12	43			18	74
01:00	0		2				2		13:00	15		8				23	
01:15	0		2				2		13:15	11		11				22	
01:30	1		1				2		13:30	4		6				10	
01:45	0	1	1	6			1	7	13:45	3	33	11	36			14	69
02:00	0		3				3		14:00	7		7				14	
02:15	0		0				0		14:15	6		10				16	
02:30	1		0				1		14:30	7		10				17	
02:45	0	1	0	3			0	4	14:45	10	30	15	42			25	72
03:00	0		1				1		15:00	8		9				17	
03:15	0		0				0		15:15	16		13				29	
03:30	0		0				0		15:30	13		13				26	
03:45	1	1	1	2			2	3	15:45	15	52	13	48			28	100
04:00	0		1				1		16:00	9		9				18	
04:15	0		0				0		16:15	8		16				24	
04:30	0		0				0		16:30	8		18				26	
04:45	0		0	1			0	1	16:45	14	39	6	49			20	88
05:00	3		2				5		17:00	11		9				20	
05:15	6		0				6		17:15	11		7				18	
05:30	1		0				1		17:30	13		9				22	
05:45	3	13	0	2			3	15	17:45	9	44	18	43			27	87
06:00	4		4				8		18:00	13		18				31	
06:15	2		2				4		18:15	9		17				26	
06:30	8		2				10		18:30	11		10				21	
06:45	4	18	1	9			5	27	18:45	5	38	8	53			13	91
07:00	12		6				18		19:00	8		12				20	
07:15	12		5				17		19:15	7		11				18	
07:30	14		2				16		19:30	6		13				19	
07:45	14	52	3	16			17	68	19:45	12	33	8	44			20	77
08:00	16		7				23		20:00	7		14				21	
08:15	14		9				23		20:15	6		14				20	
08:30	15		4				19		20:30	4		10				14	
08:45	16	61	2	22			18	83	20:45	4	21	10	48			14	69
09:00	15		9				24		21:00	4		6				10	
09:15	16		8				24		21:15	4		7				11	
09:30	15		10				25		21:30	9		13				22	
09:45	21	67	7	34			28	101	21:45	4	21	13	39			17	60
10:00	7		15				22		22:00	6		9				15	
10:15	11		9				20		22:15	2		5				7	
10:30	7		5				12		22:30	2		5				7	
10:45	8	33	6	35			14	68	22:45	0	10	10	29			10	39
11:00	6		5				11		23:00	4		5				9	
11:15	12		7				19		23:15	2		2				4	
11:30	9		4				13		23:30	0		3				3	
11:45	11	38	5	21			16	59	23:45	0	6	5	15			5	21
TOTALS		292		163				455	TOTALS		358		489				847
SPLIT %		64.2%		35.8%				34.9%	SPLIT %		42.3%		57.7%				65.1%

DAILY TOTALS	NB	SB	EB	WB	Total
	650	652	0	0	1,302

AM Peak Hour	09:00	09:30				09:00	PM Peak Hour	15:15	17:45				17:30
AM Pk Volume	67	41				101	PM Pk Volume	53	63				106
Pk Hr Factor	0.798	0.683				0.902	Pk Hr Factor	0.828	0.875				0.855
7 - 9 Volume	113	38	0	0		151	4 - 6 Volume	83	92	0	0		175
7 - 9 Peak Hour	08:00	07:45				08:00	4 - 6 Peak Hour	16:45	16:00				16:15
7 - 9 Pk Volume	61	23	0	0		83	4 - 6 Pk Volume	49	49	0	0		90
Pk Hr Factor	0.953	0.639	0.000	0.000		0.902	Pk Hr Factor	0.875	0.681	0.000	0.000		0.865

Prepared by NDS/ATD

VOLUME

Staunton Dr N/O SR 120/Duluth Hwy

Day: Wednesday
Date: 5/13/2015

City: Duluth
Project #: GA15_9189_005

DAILY TOTALS	NB	SB	EB	WB	Total
	428	417	0	0	845

AM Period	NB		SB		EB		WB		TOTAL		PM Period	NB		SB		EB		WB		TOTAL	
00:00	2		0						2		12:00	4		0						4	
00:15	2		1						3		12:15	3		11						14	
00:30	0		0						0		12:30	4		3						7	
00:45	1	5	1	2					2	7	12:45	6	17	5	19					11	36
01:00	0		0						0		13:00	3		2						5	
01:15	0		0						0		13:15	10		3						13	
01:30	1		0						1		13:30	5		6						11	
01:45	1	2	0						1	2	13:45	5	23	6	17					11	40
02:00	0		0						0		14:00	4		2						6	
02:15	1		0						1		14:15	7		3						10	
02:30	0		0						0		14:30	7		4						11	
02:45	4	5	0						4	5	14:45	8	26	5	14					13	40
03:00	0		1						1		15:00	15		4						19	
03:15	0		0						0		15:15	4		5						9	
03:30	0		0						0		15:30	3		10						13	
03:45	0		0	1					0	1	15:45	4	26	0	19					4	45
04:00	0		0						0		16:00	4		4						8	
04:15	1		1						2		16:15	5		4						9	
04:30	0		0						0		16:30	5		3						8	
04:45	0	1	1	2					1	3	16:45	7	21	4	15					11	36
05:00	0		0						0		17:00	7		4						11	
05:15	0		4						4		17:15	9		5						14	
05:30	1		6						7		17:30	8		8						16	
05:45	1	2	2	12					3	14	17:45	5	29	10	27					15	56
06:00	1		3						4		18:00	10		6						16	
06:15	1		4						5		18:15	11		2						13	
06:30	0		1						1		18:30	13		8						21	
06:45	0	2	3	11					3	13	18:45	13	47	4	20					17	67
07:00	1		2						3		19:00	9		2						11	
07:15	1		7						8		19:15	11		8						19	
07:30	4		14						18		19:30	10		11						21	
07:45	6	12	33	56					39	68	19:45	8	38	6	27					14	65
08:00	13		25						38		20:00	5		6						11	
08:15	10		7						17		20:15	9		2						11	
08:30	4		8						12		20:30	6		4						10	
08:45	2	29	10	50					12	79	20:45	8	28	3	15					11	43
09:00	6		5						11		21:00	17		2						19	
09:15	5		9						14		21:15	5		5						10	
09:30	4		11						15		21:30	7		13						20	
09:45	4	19	5	30					9	49	21:45	6	35	1	21					7	56
10:00	8		10						18		22:00	3		1						4	
10:15	4		9						13		22:15	3		1						4	
10:30	3		4						7		22:30	1		0						1	
10:45	3	18	5	28					8	46	22:45	3	10	2	4					5	14
11:00	10		4						14		23:00	3		2						5	
11:15	3		7						10		23:15	2		0						2	
11:30	4		7						11		23:30	2		0						2	
11:45	7	24	7	25					14	49	23:45	2	9	0	2					2	11
TOTALS		119		217						336	TOTALS		309		200						509
SPLIT %		35.4%		64.6%						39.8%	SPLIT %		60.7%		39.3%						60.2%

DAILY TOTALS	NB	SB	EB	WB	Total
	428	417	0	0	845

AM Peak Hour	07:30	07:15			07:30	PM Peak Hour	18:00	19:15			18:30
AM Pk Volume	33	79			112	PM Pk Volume	47	31			68
Pk Hr Factor	0.635	0.598			0.718	Pk Hr Factor	0.904	0.705			0.810
7 - 9 Volume	41	106	0	0	147	4 - 6 Volume	50	42	0	0	92
7 - 9 Peak Hour	07:30	07:15			07:30	4 - 6 Peak Hour	16:45	17:00			17:00
7 - 9 Pk Volume	33	79	0	0	112	4 - 6 Pk Volume	31	27	0	0	56
Pk Hr Factor	0.635	0.598	0.000	0.000	0.718	Pk Hr Factor	0.861	0.675	0.000	0.000	0.875

Prepared by NDS/ATD

VOLUME

SR 120/Duluth Hwy E/O Northmont Pkwy

Day: Wednesday
Date: 5/13/2015

City: Duluth
Project #: GA15_9189_004

DAILY TOTALS	NB	SB	EB	WB	Total
	0	0	12,114	12,367	24,481

AM Period	NB	SB	EB		WB		TOTAL		PM Period	NB	SB	EB		WB		TOTAL	
00:00			23		16		39		12:00			223		168		391	
00:15			19		24		43		12:15			177		173		350	
00:30			17		20		37		12:30			173		157		330	
00:45			12	71	13	73	25	144	12:45			161	734	175	673	336	1407
01:00			8		5		13		13:00			171		177		348	
01:15			10		6		16		13:15			168		144		312	
01:30			12		10		22		13:30			145		160		305	
01:45			9	39	5	26	14	65	13:45			171	655	168	649	339	1304
02:00			7		3		10		14:00			178		169		347	
02:15			4		8		12		14:15			200		169		369	
02:30			6		9		15		14:30			202		174		376	
02:45			8	25	9	29	17	54	14:45			207	787	175	687	382	1474
03:00			4		4		8		15:00			230		138		368	
03:15			15		9		24		15:15			190		163		353	
03:30			6		8		14		15:30			219		176		395	
03:45			7	32	4	25	11	57	15:45			197	836	161	638	358	1474
04:00			11		6		17		16:00			222		182		404	
04:15			14		12		26		16:15			253		177		430	
04:30			17		27		44		16:30			243		188		431	
04:45			16	58	27	72	43	130	16:45			263	981	174	721	437	1702
05:00			27		44		71		17:00			288		195		483	
05:15			26		71		97		17:15			280		239		519	
05:30			41		74		115		17:30			266		226		492	
05:45			37	131	92	281	129	412	17:45			266	1100	207	867	473	1967
06:00			74		125		199		18:00			246		224		470	
06:15			79		179		258		18:15			278		210		488	
06:30			109		223		332		18:30			234		188		422	
06:45			117	379	260	787	377	1166	18:45			243	1001	179	801	422	1802
07:00			144		249		393		19:00			233		157		390	
07:15			121		275		396		19:15			200		158		358	
07:30			139		300		439		19:30			189		148		337	
07:45			212	616	290	1114	502	1730	19:45			182	804	145	608	327	1412
08:00			210		283		493		20:00			161		113		274	
08:15			204		267		471		20:15			142		120		262	
08:30			164		248		412		20:30			124		109		233	
08:45			150	728	244	1042	394	1770	20:45			128	555	85	427	213	982
09:00			147		239		386		21:00			136		97		233	
09:15			143		206		349		21:15			155		94		249	
09:30			151		209		360		21:30			111		86		197	
09:45			121	562	187	841	308	1403	21:45			84	486	97	374	181	860
10:00			168		195		363		22:00			94		83		177	
10:15			112		160		272		22:15			48		53		101	
10:30			113		161		274		22:30			43		47		90	
10:45			150	543	143	659	293	1202	22:45			42	227	56	239	98	466
11:00			135		148		283		23:00			61		39		100	
11:15			150		131		281		23:15			44		32		76	
11:30			160		160		320		23:30			25		28		53	
11:45			164	609	167	606	331	1215	23:45			25	155	29	128	54	283
TOTALS				3793		5555		**9348**	**TOTALS**				8321		6812		**15133**
SPLIT %				40.6%		59.4%		**38.2%**	**SPLIT %**				55.0%		45.0%		**61.8%**

DAILY TOTALS	NB	SB	EB	WB	Total
	0	0	12,114	12,367	24,481

AM Peak Hour			07:45	07:15	**07:30**	**PM Peak Hour**			17:00	17:15	**17:00**
AM Pk Volume			790	1148	**1905**	**PM Pk Volume**			1100	896	**1967**
Pk Hr Factor			0.932	0.957	**0.949**	**Pk Hr Factor**			0.955	0.937	**0.947**
7 - 9 Volume	0	0	1344	2156	**3500**	**4 - 6 Volume**	0	0	2081	1588	**3669**
7 - 9 Peak Hour			07:45	07:15	**07:30**	**4 - 6 Peak Hour**			17:00	17:00	**17:00**
7 - 9 Pk Volume	0	0	790	1148	**1905**	**4 - 6 Pk Volume**	0	0	1100	867	**1967**
Pk Hr Factor	0.000	0.000	0.932	0.957	**0.949**	**Pk Hr Factor**	0.000	0.000	0.955	0.907	**0.947**

Prepared by NDS/ATD

VOLUME

Northmont Pkwy S/O SR 120/Duluth Hwy

Day: Wednesday
Date: 5/13/2015

City: Duluth
Project #: GA15_9189_003

DAILY TOTALS	NB	SB	EB	WB	Total
	3,594	4,150	0	0	7,744

AM Period	NB		SB		EB	WB	TOTAL		PM Period	NB		SB		EB	WB	TOTAL	
00:00	13		7				20		12:00	77		57				134	
00:15	10		6				16		12:15	64		61				125	
00:30	4		4				8		12:30	68		74				142	
00:45	5	32	3	20			8	52	12:45	53	262	72	264			125	526
01:00	5		1				6		13:00	72		78				150	
01:15	6		4				10		13:15	58		76				134	
01:30	1		3				4		13:30	61		44				105	
01:45	2	14	5	13			7	27	13:45	53	244	66	264			119	508
02:00	3		3				6		14:00	52		64				116	
02:15	0		2				2		14:15	47		63				110	
02:30	4		2				6		14:30	52		52				104	
02:45	3	10	1	8			4	18	14:45	61	212	55	234			116	446
03:00	2		2				4		15:00	62		33				95	
03:15	0		1				1		15:15	51		65				116	
03:30	5		3				8		15:30	60		56				116	
03:45	10	17	4	10			14	27	15:45	54	227	51	205			105	432
04:00	4		2				6		16:00	70		51				121	
04:15	2		4				6		16:15	70		46				116	
04:30	2		6				8		16:30	95		37				132	
04:45	5	13	11	23			16	36	16:45	94	329	47	181			141	510
05:00	14		8				22		17:00	149		66				215	
05:15	16		4				20		17:15	113		63				176	
05:30	5		5				10		17:30	115		75				190	
05:45	12	47	17	34			29	81	17:45	100	477	65	269			165	746
06:00	9		15				24		18:00	82		73				155	
06:15	12		29				41		18:15	88		58				146	
06:30	25		52				77		18:30	72		52				124	
06:45	31	77	78	174			109	251	18:45	53	295	42	225			95	520
07:00	31		108				139		19:00	63		44				107	
07:15	20		113				133		19:15	54		49				103	
07:30	44		124				168		19:30	51		48				99	
07:45	44	139	124	469			168	608	19:45	51	219	49	190			100	409
08:00	40		122				162		20:00	58		28				86	
08:15	46		150				196		20:15	43		19				62	
08:30	31		125				156		20:30	32		22				54	
08:45	31	148	136	533			167	681	20:45	32	165	19	88			51	253
09:00	30		96				126		21:00	38		29				67	
09:15	29		82				111		21:15	34		35				69	
09:30	36		74				110		21:30	34		18				52	
09:45	27	122	76	328			103	450	21:45	18	124	28	110			46	234
10:00	24		63				87		22:00	23		17				40	
10:15	41		68				109		22:15	22		7				29	
10:30	30		32				62		22:30	8		6				14	
10:45	30	125	64	227			94	352	22:45	6	59	14	44			20	103
11:00	36		45				81		23:00	20		6				26	
11:15	40		53				93		23:15	14		7				21	
11:30	50		49				99		23:30	6		5				11	
11:45	56	182	61	208			117	390	23:45	15	55	11	29			26	84
TOTALS		926		2047				**2973**	**TOTALS**		2668		2103				**4771**
SPLIT %		31.1%		68.9%				**38.4%**	**SPLIT %**		55.9%		44.1%				**61.6%**

DAILY TOTALS	NB	SB	EB	WB	Total
	3,594	4,150	0	0	7,744

AM Peak Hour	11:45	08:00			**07:30**	**PM Peak Hour**	17:00	12:30			**17:00**
AM Pk Volume	265	533			**694**	**PM Pk Volume**	477	300			**746**
Pk Hr Factor	0.860	0.888			**0.885**	**Pk Hr Factor**	0.800	0.962			**0.867**
7 - 9 Volume	287	1002	0	0	**1289**	**4 - 6 Volume**	806	450	0	0	**1256**
7 - 9 Peak Hour	07:30	08:00			**07:30**	**4 - 6 Peak Hour**	17:00	17:00			**17:00**
7 - 9 Pk Volume	174	533	0	0	**694**	**4 - 6 Pk Volume**	477	269	0	0	**746**
Pk Hr Factor	0.946	0.888	0.000	0.000	**0.885**	**Pk Hr Factor**	0.800	0.897	0.000	0.000	**0.867**

Prepared by NDS/ATD

VOLUME

Northmont Pkwy N/O SR 120/Duluth Hwy

Day: Wednesday
Date: 5/13/2015

City: Duluth
Project #: GA15_9189_002

DAILY TOTALS	NB	SB	EB	WB	Total
	263	269	0	0	532

AM Period	NB		SB		EB		WB		TOTAL		PM Period	NB		SB		EB		WB		TOTAL	
00:00	2		1						3		12:00	3		4						7	
00:15	0		0						0		12:15	4		5						9	
00:30	0		0						0		12:30	8		8						16	
00:45	0	2	0	1					0	3	12:45	7	22	5	22					12	44
01:00	0		0						0		13:00	1		4						5	
01:15	0		0						0		13:15	2		4						6	
01:30	0		0						0		13:30	3		1						4	
01:45	0		0						0		13:45	2	8	0	9					2	17
02:00	0		0						0		14:00	6		2						8	
02:15	1		0						1		14:15	5		3						8	
02:30	0		0						0		14:30	3		4						7	
02:45	0	1	0						0	1	14:45	2	16	5	14					7	30
03:00	0		0						0		15:00	8		7						15	
03:15	0		0						0		15:15	3		3						6	
03:30	0		0						0		15:30	7		4						11	
03:45	0		0						0		15:45	4	22	1	15					5	37
04:00	1		1						2		16:00	2		1						3	
04:15	0		1						1		16:15	4		6						10	
04:30	0		0						0		16:30	4		4						8	
04:45	0	1	0	2					0	3	16:45	5	15	3	14					8	29
05:00	0		0						0		17:00	2		2						4	
05:15	0		1						1		17:15	8		4						12	
05:30	0		1						1		17:30	7		3						10	
05:45	0		1	3					1	3	17:45	11	28	5	14					16	42
06:00	1		3						4		18:00	7		3						10	
06:15	1		5						6		18:15	5		11						16	
06:30	2		7						9		18:30	7		5						12	
06:45	1	5	5	20					6	25	18:45	7	26	5	24					12	50
07:00	0		2						2		19:00	6		2						8	
07:15	1		6						7		19:15	5		5						10	
07:30	2		6						8		19:30	2		2						4	
07:45	3	6	4	18					7	24	19:45	4	17	3	12					7	29
08:00	2		9						11		20:00	5		3						8	
08:15	7		6						13		20:15	1		1						2	
08:30	3		7						10		20:30	5		0						5	
08:45	3	15	9	31					12	46	20:45	5	16	2	6					7	22
09:00	1		5						6		21:00	7		2						9	
09:15	2		5						7		21:15	7		1						8	
09:30	3		9						12		21:30	7		1						8	
09:45	5	11	5	24					10	35	21:45	2	23	2	6					4	29
10:00	1		6						7		22:00	2		3						5	
10:15	0		5						5		22:15	1		0						1	
10:30	1		3						4		22:30	3		0						3	
10:45	1	3	2	16					3	19	22:45	5	11	1	4					6	15
11:00	4		4						8		23:00	1		0						1	
11:15	2		5						7		23:15	0		0						0	
11:30	5		2						7		23:30	0		0						0	
11:45	3	14	2	13					5	27	23:45	0	1	1	1					1	2
TOTALS		58		128						**186**	**TOTALS**		205		141						**346**
SPLIT %		31.2%		68.8%						**35.0%**	**SPLIT %**		59.2%		40.8%						**65.0%**

DAILY TOTALS	NB	SB	EB	WB	Total
	263	269	0	0	532

AM Peak Hour	11:45	08:00			**08:00**	**PM Peak Hour**	17:15	17:45			**17:45**
AM Pk Volume	18	31			**46**	**PM Pk Volume**	33	24			**54**
Pk Hr Factor	0.563	0.861			**0.885**	**Pk Hr Factor**	0.750	0.545			**0.844**
7 - 9 Volume	21	49	0	0	**70**	**4 - 6 Volume**	43	28	0	0	**71**
7 - 9 Peak Hour	07:45	08:00			**08:00**	**4 - 6 Peak Hour**	17:00	16:15			**17:00**
7 - 9 Pk Volume	15	31	0	0	**46**	**4 - 6 Pk Volume**	28	15	0	0	**42**
Pk Hr Factor	0.536	0.861	0.000	0.000	**0.885**	**Pk Hr Factor**	0.636	0.625	0.000	0.000	**0.656**

Prepared by National Data & Surveying Services

CLASSIFICATION

SR 120/Duluth Hwy W/O Northmont Pkwy

Day: Wednesday
Date: 5/13/2015

City: Duluth
Project #: GA15_9189_001

Summary

Time	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	# 10	# 11	# 12	# 13	Total
00:00 AM	1	120	10	1	5	1	0	0	0	0	0	0	0	138
01:00	0	65	3	0	2	0	0	1	0	0	0	0	0	71
02:00	0	50	2	0	1	0	0	1	1	0	0	0	0	55
03:00	0	47	3	0	1	0	0	1	0	0	0	0	0	52
04:00	0	112	10	0	5	0	0	1	1	0	0	0	0	129
05:00	2	357	31	2	26	1	0	2	0	0	0	0	0	421
06:00	2	979	140	8	94	1	0	3	4	0	0	0	0	1231
07:00	2	1454	207	15	128	2	0	5	5	0	0	0	0	1818
08:00	0	1593	184	10	117	2	0	3	5	0	0	0	0	1914
09:00	2	1139	166	3	101	7	0	7	11	0	0	0	0	1436
10:00	0	950	156	11	96	9	0	2	3	0	0	0	0	1227
11:00	2	856	153	8	83	5	1	4	4	0	0	0	0	1116
12:00 PM	2	1028	172	6	91	4	0	4	4	0	0	0	0	1311
13:00	2	1022	163	8	79	3	0	4	3	0	0	0	0	1284
14:00	5	1144	175	9	117	4	0	6	10	0	0	0	0	1470
15:00	1	1303	163	13	103	4	1	4	5	0	0	0	0	1597
16:00	5	1491	167	4	105	1	0	6	4	0	0	0	0	1783
17:00	2	1719	177	5	75	0	1	4	3	0	0	0	0	1986
18:00	2	1574	182	2	100	0	0	3	1	0	0	0	0	1864
19:00	2	1326	147	2	66	1	0	2	0	0	0	0	0	1546
20:00	0	882	90	1	59	0	0	0	1	0	0	0	0	1033
21:00	1	793	89	0	34	0	0	0	2	0	0	0	0	919
22:00	0	444	36	0	14	0	0	0	2	0	0	0	0	496
23:00	0	273	28	0	6	0	0	0	0	0	0	0	0	307
Totals	33	20721	2654	108	1508	45	3	63	69					25204
% of Totals	0%	82%	11%	0%	6%	0%	0%	0%	0%					100%

AM Volumes	11	7722	1065	58	659	28	1	30	34	0	0	0	0	9608
% AM	0%	31%	4%	0%	3%	0%	0%	0%	0%					38%
AM Peak Hour	05:00	08:00	07:00	07:00	07:00	10:00	11:00	09:00	09:00					08:00
Volume	2	1593	207	15	128	9	1	7	11					1914
PM Volumes	22	12999	1589	50	849	17	2	33	35	0	0	0	0	15596
% PM	0%	52%	6%	0%	3%	0%	0%	0%	0%					62%
PM Peak Hour	14:00	17:00	18:00	15:00	14:00	12:00	15:00	14:00	14:00					17:00
Volume	5	1719	182	13	117	4	1	6	10					1986

Directional Peak Periods	AM 7-9		NOON 12-2		PM 4-6		Off Peak Volumes	
All Classes	Volume	%	Volume	%	Volume	%	Volume	%
	3732	15%	2595	10%	3769	15%	15108	60%

Classification Definitions

1 Motorcycles
2 Passenger Cars
3 2-Axle, 4-Tire Single Units
4 Buses
5 2-Axle, 6-Tire Single Units
6 3-Axle Single Units
7 > =4-Axle Single Units
8 <=4-Axle Single Trailers
9 5-Axle Single Trailers
10 >=6-Axle Single Trailers
11 <=5-Axle Multi-Trailers
12 6-Axle Multi-Trailers
13 >=7-Axle Multi-Trailers

ITM Peak Hour Summary

Prepared by:

National Data & Surveying Services

Staunton Dr and SR 120_Duluth Hwy , Duluth

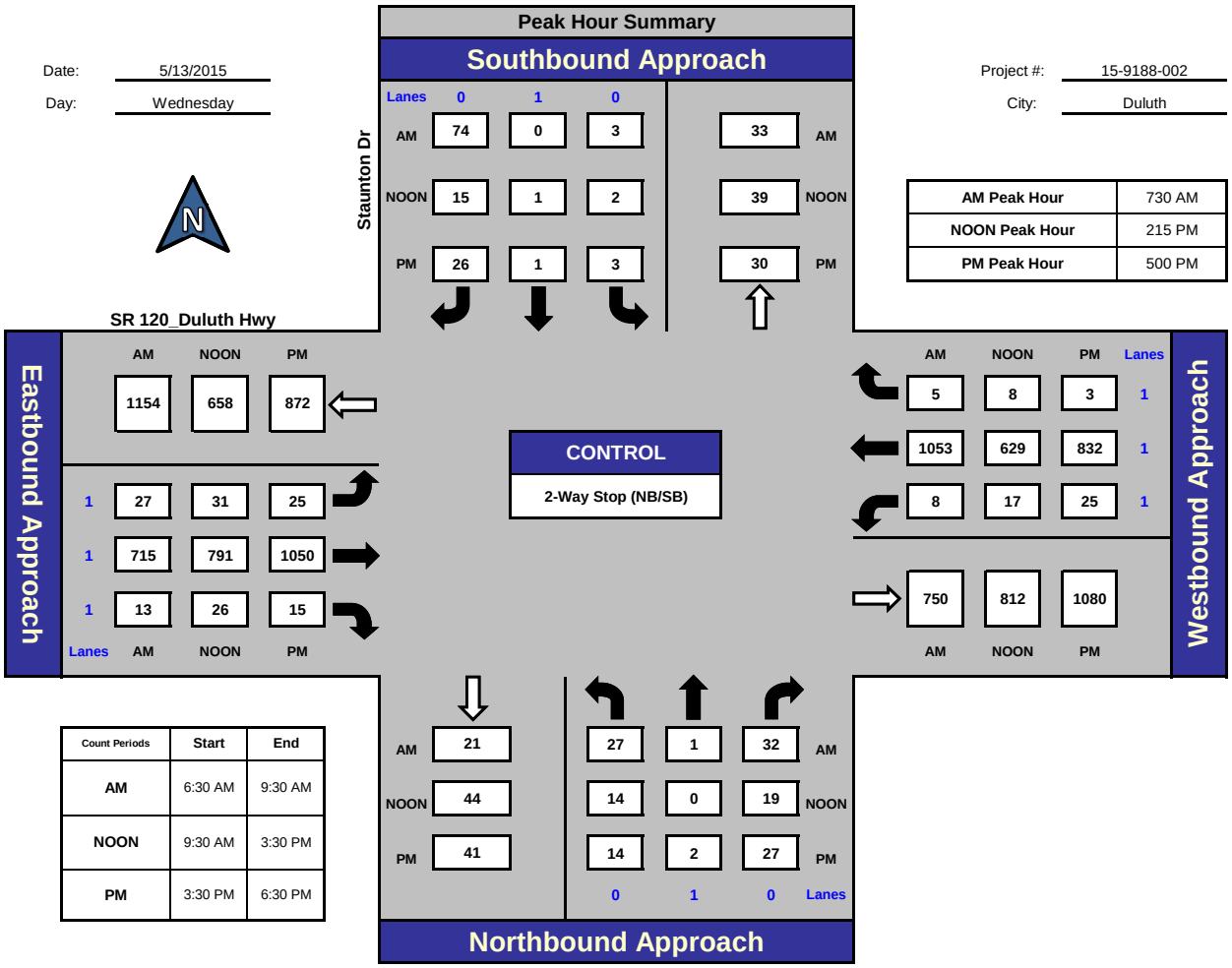
Date: 5/13/2015

Day: Wednesday

Project #: 15-9188-002

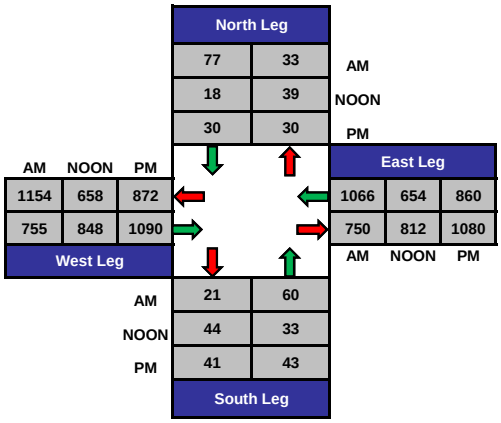
City: Duluth

AM Peak Hour	730 AM
NOON Peak Hour	215 PM
PM Peak Hour	500 PM

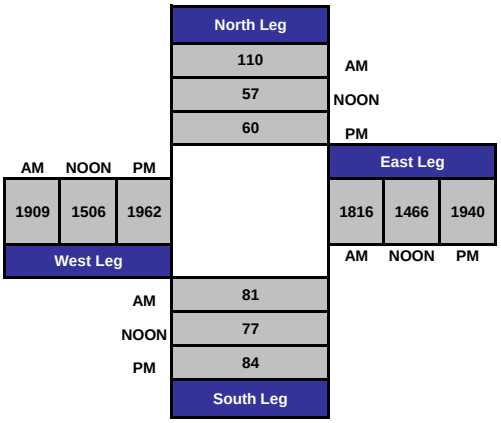


Count Periods	Start	End
AM	6:30 AM	9:30 AM
NOON	9:30 AM	3:30 PM
PM	3:30 PM	6:30 PM

Total Ins & Outs



Total Volume Per Leg



ITM Peak Hour Summary

Prepared by:

National Data & Surveying Services

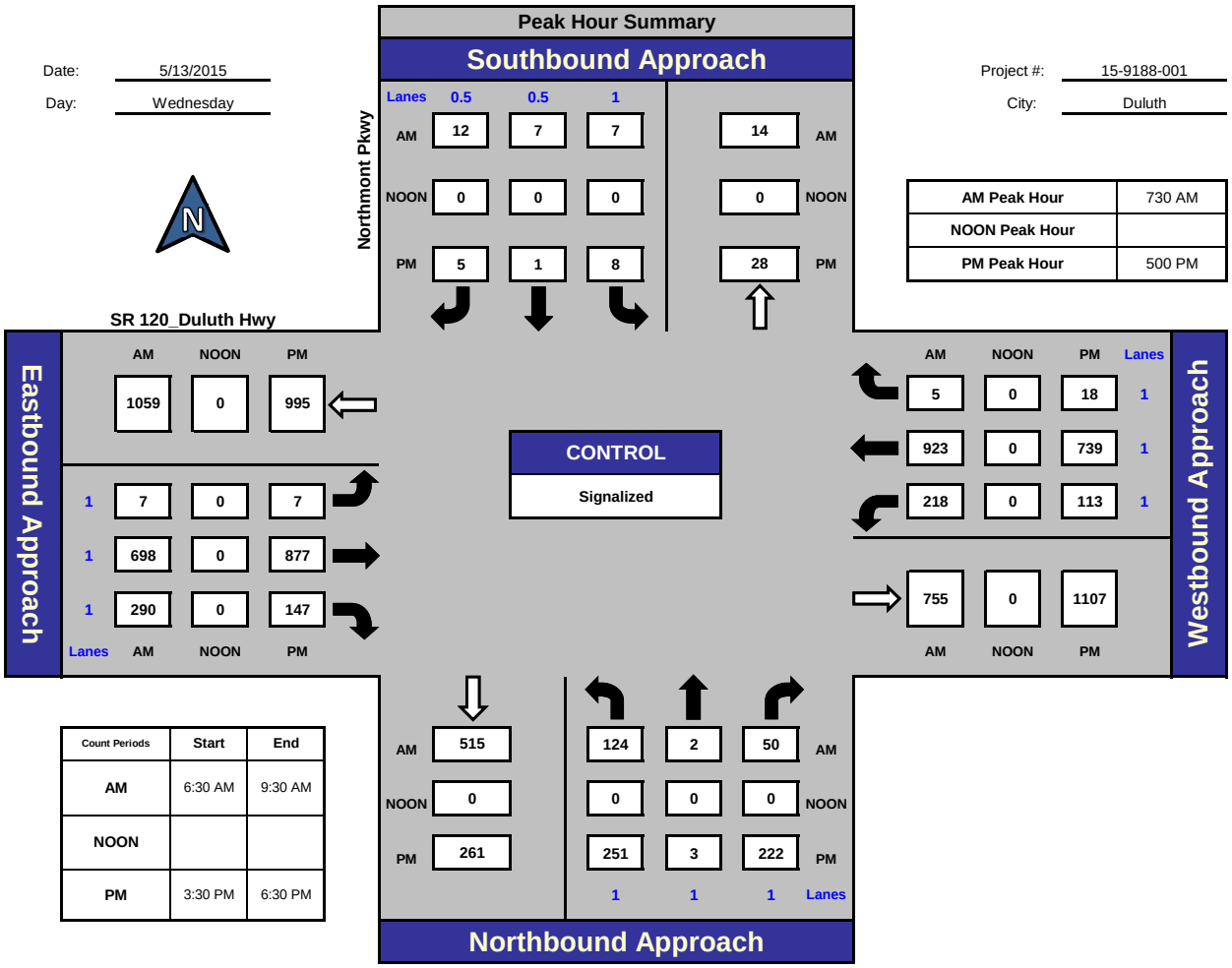
Northmont Pkwy and SR 120_Duluth Hwy , Duluth

Date: 5/13/2015

Day: Wednesday

Project #: 15-9188-001

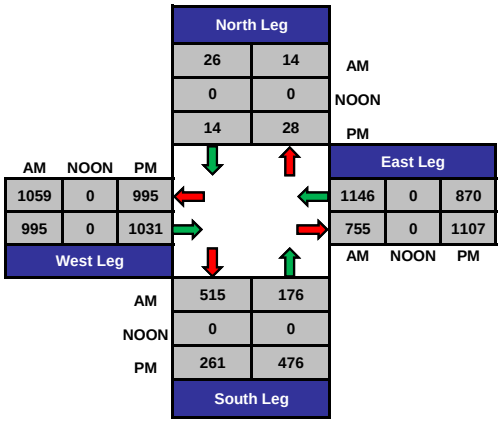
City: Duluth



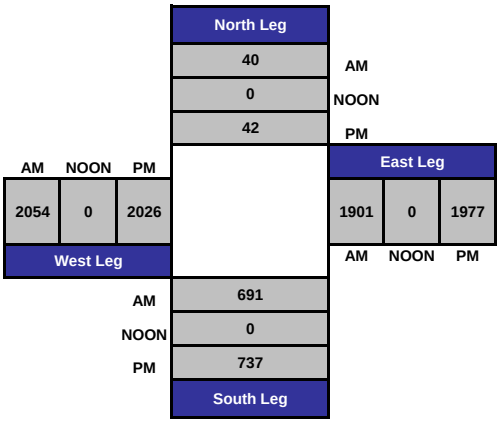
AM Peak Hour	730 AM
NOON Peak Hour	
PM Peak Hour	500 PM

Count Periods	Start	End
AM	6:30 AM	9:30 AM
NOON		
PM	3:30 PM	6:30 PM

Total Ins & Outs



Total Volume Per Leg



Appendix C: K&D Worksheet

Peak Hour Factor and Directional Distribution Worksheet

AM Peak End Time 8:30
PM Peak End Time 18:00

Shaded Cells are manually entered | Blank Cells are calculated

		Raw Counts and Information								Calculations					
						AM		PM		AM	PM	AM	PM	AM	PM
Count #	Year	Daily Traffic	Location Description	Type of Count*	Mainline or Sidestreet	East/North Bound	West/South Bound	East/North Bound	West/South Bound	Total Hourly Traffic		K Value		D Factor†	
1	2015	25,204	SR 120 west of Northmont Pkwy	Class	M	987	1,037	998	988	2024	1986	0.08	0.08	0.51 ←	0.5 →
2	2015	532	Northmont Pkwy north of SR 120	Volume	S	14	25	28	14	39	42	0.07	0.08	0.64 ↓	0.67 ↑
3	2015	7,744	Northmont Pkwy south of SR 120	Volume	S	174	520	477	269	694	746	0.09	0.10	0.75 ↓	0.64 ↑
4	2015	24,481	SR 120 between Northmont Pkwy and Staunton Dr.	Volume	M	765	1,140	1,100	867	1905	1967	0.08	0.08	0.6 ←	0.56 →
5	2015	845	Staunton Dr. north of SR 120	Volume	S	33	79	29	27	112	56	0.13	0.07	0.71 ↓	0.52 ↑
6	2015	1,302	Staunton Dr. south of SR 120	Volume	S	58	21	44	43	79	87	0.06	0.07	0.73 ↑	0.51 ↑
7	2015	24,111	SR 120 east of Staunton Drive	Volume	M	760	1,061	1,092	860	1821	1952	0.08	0.08	0.58 ←	0.56 →
135-0161	2014	19,500	SR 120 Between Buford Hwy and Knox Branch Creek	AADT	M	not available	not available	not available	not available	1676	1494	0.09	0.08	not available	not available
135-0163	2015	23,320	SR 120 Between Knox Branch Creek and Satellite Blvd.	AADT	M	not available	not available	not available	not available	1646	1690	0.07	0.07	not available	not available
135-0527	2015	24,320	Boggs Rd Between SR 120 and Satellite Blvd.	AADT	S	not available	not available	not available	not available	1038	860	0.04	0.04	not available	not available

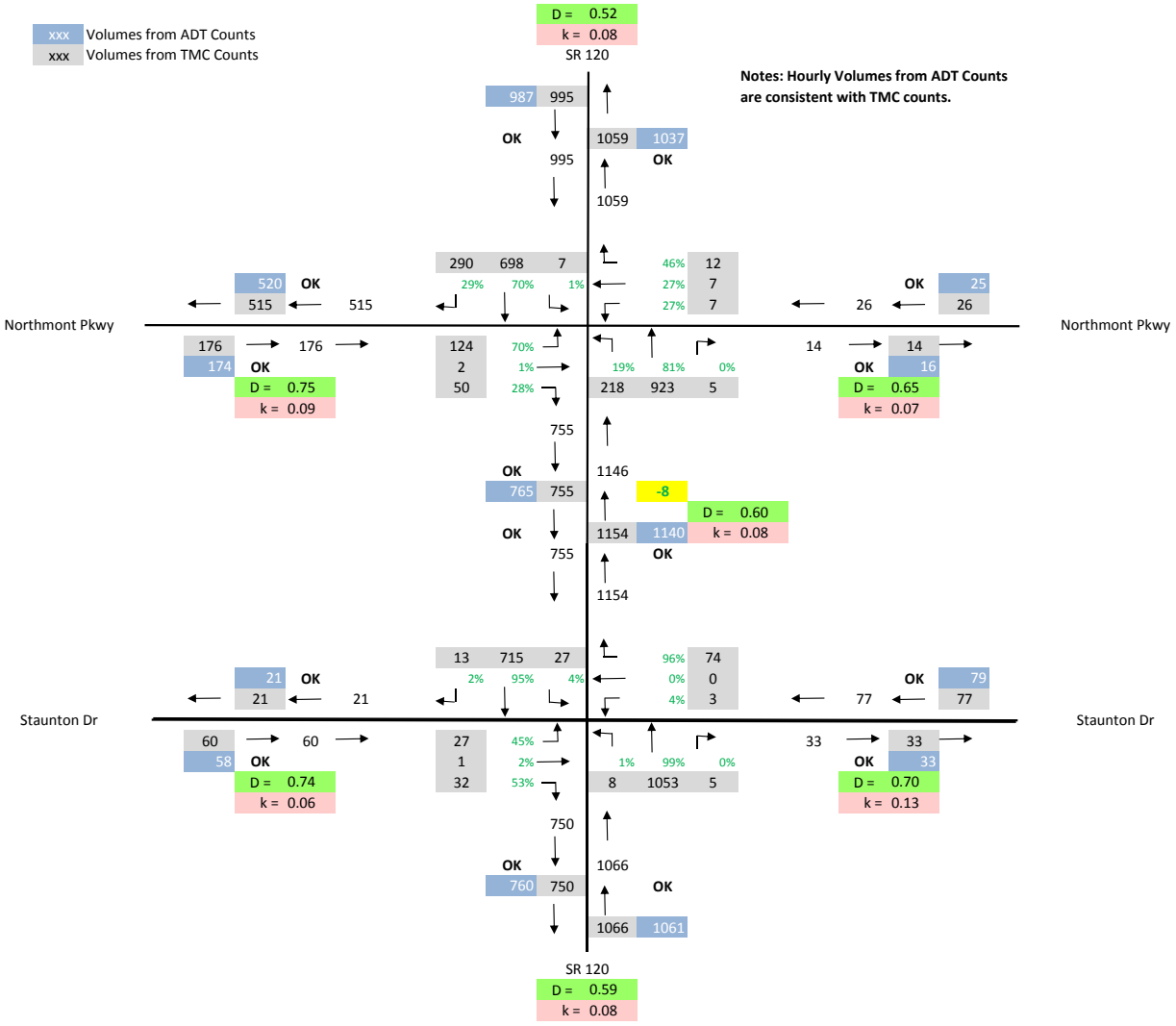
* AADT counts from GDOT Count Stations, Volume and Class counts by tubes

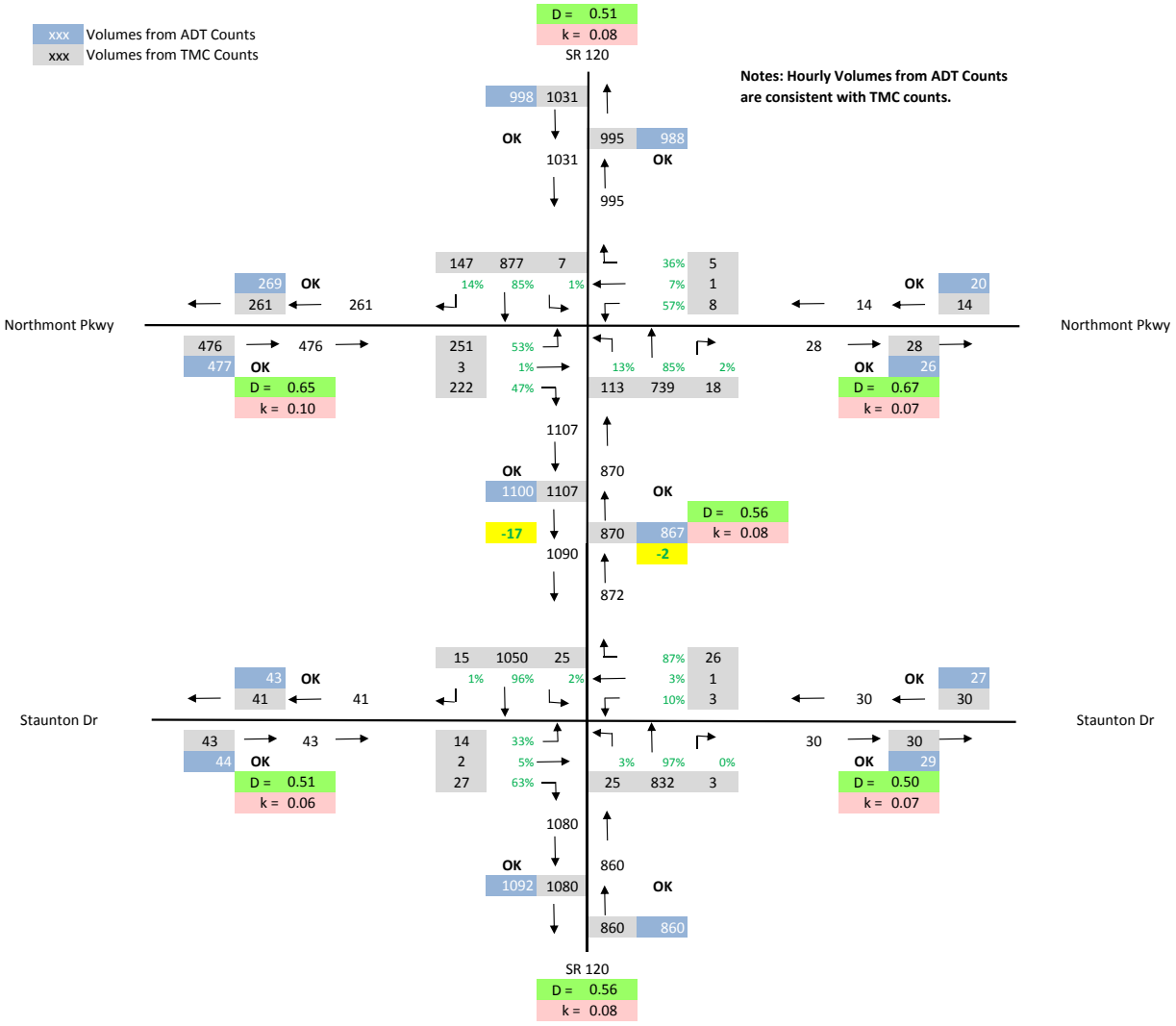
† D values are measured by the largest direction movement and are thus never less than 0.50

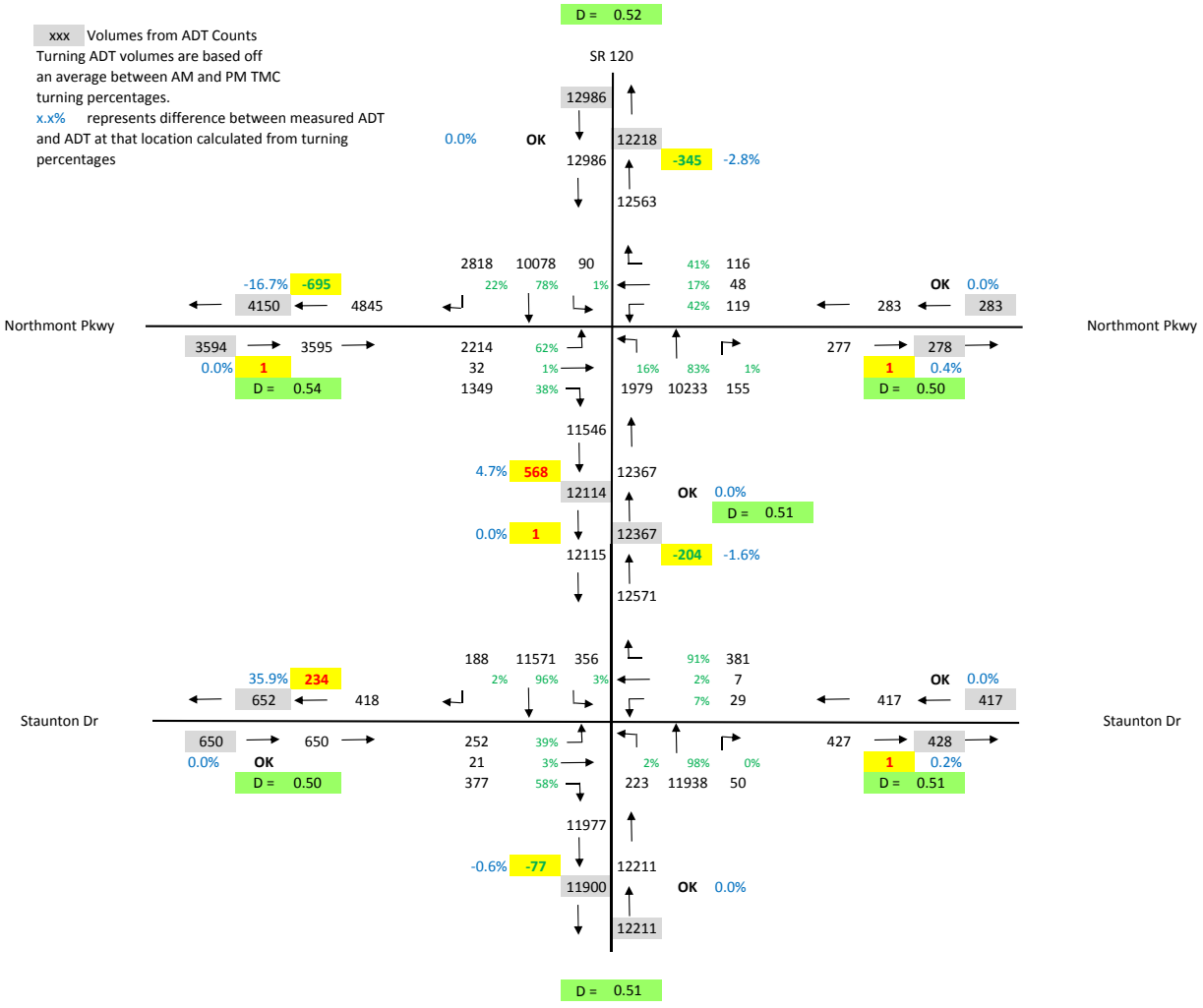
NOTE: Where GDOT Count Stations are used, the Daily Traffic and Peak Hour volumes reported are those of the raw count, not the AADT.

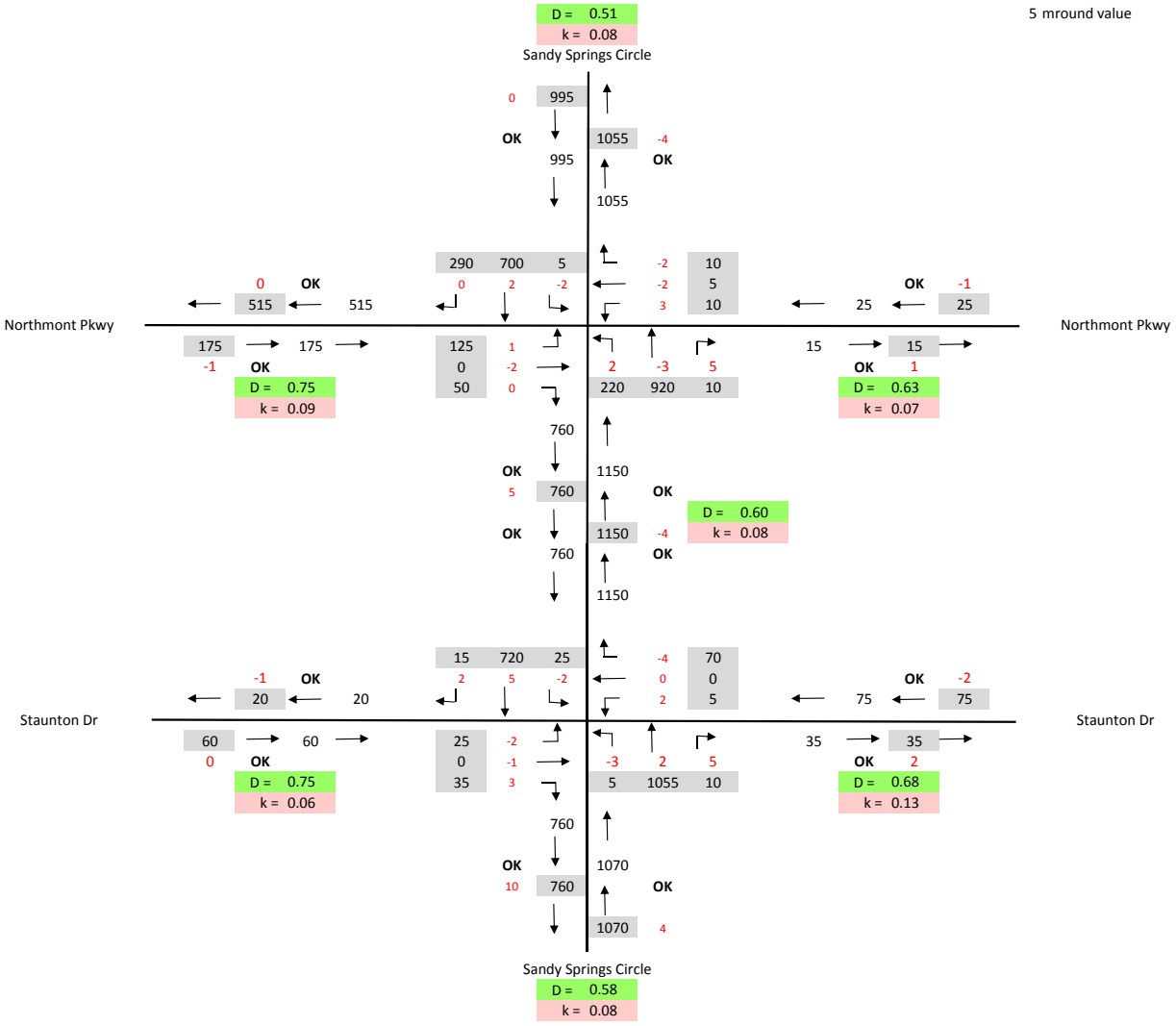
Weighted Average	**0.07**	**0.07**
Mainline Weighted Average	0.08	0.08
Sidestreet Weighted Average	0.06	0.05

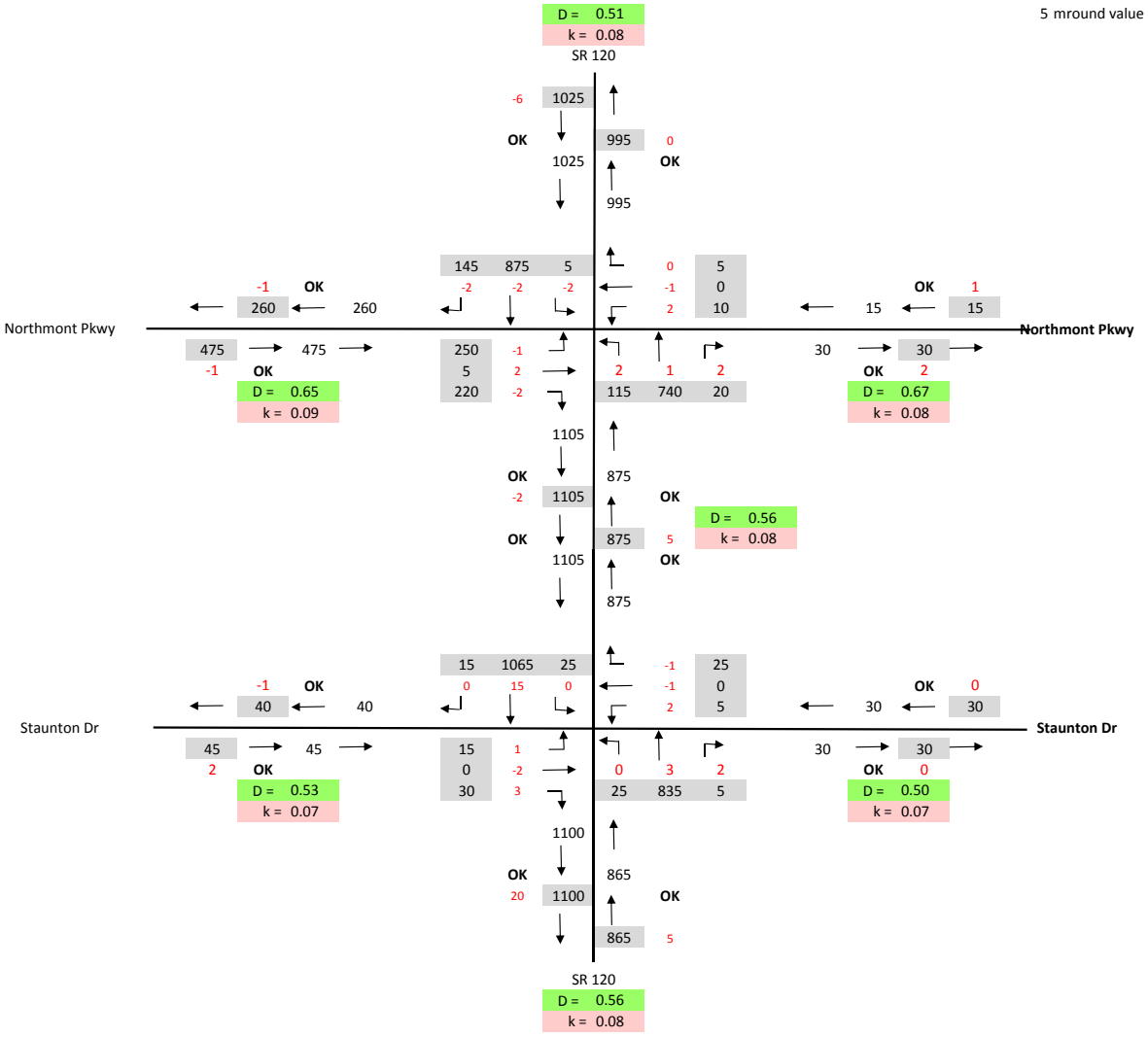
Appendix D: Design Traffic Worksheets

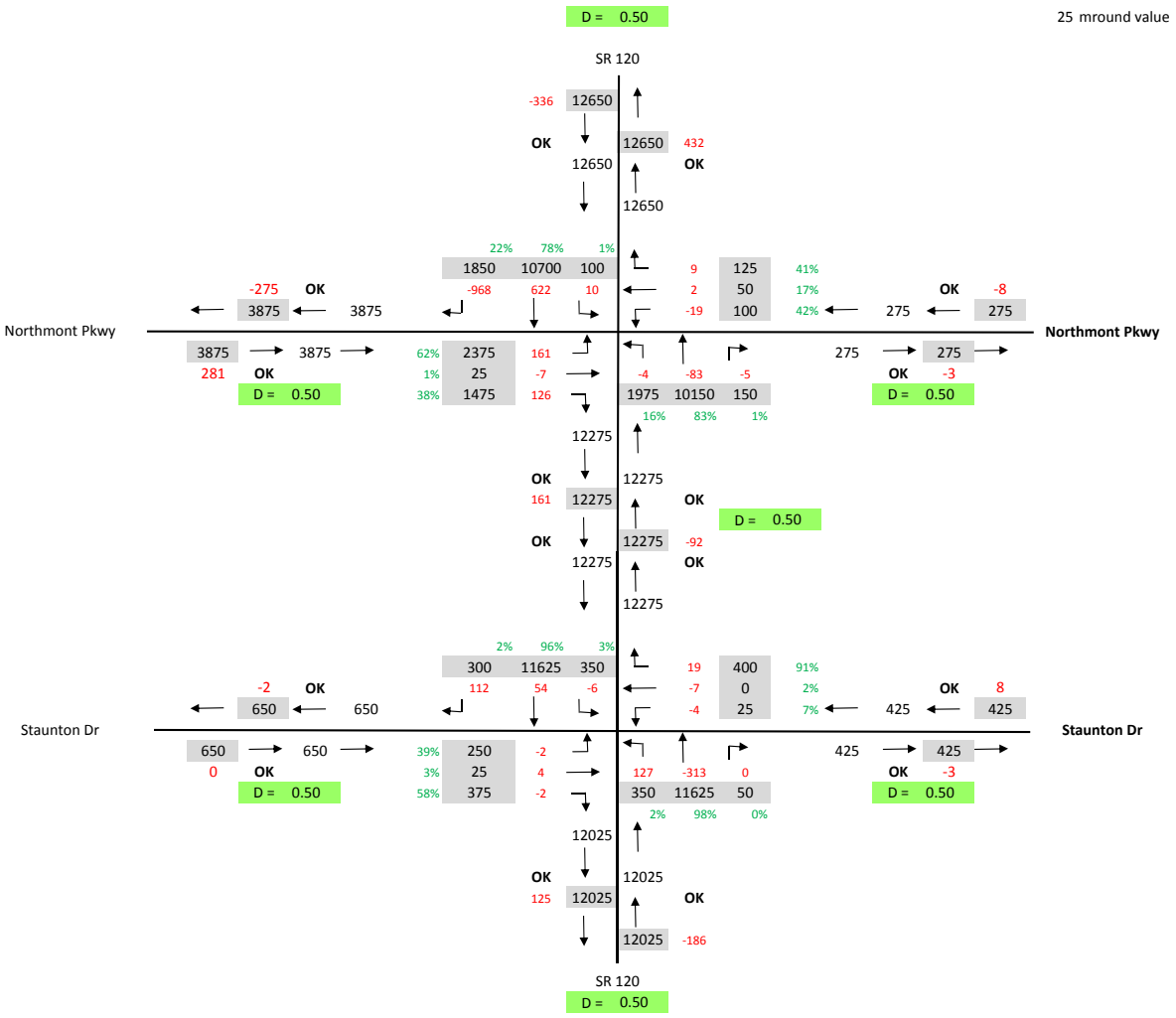

xxx Volumes from ADT Counts
xxx Volumes from TMC Counts
D = 0.52
k = 0.08
SR 120
Notes: Hourly Volumes from ADT Counts are consistent with TMC counts.
987 995
OK
995
1059 1037
OK
1059
290 698 7
29% 70% 1%
46% 12
27% 7
27% 7
520 OK
515 515
OK 25
26 26
Northmont Pkwy
Northmont Pkwy
176 176
174 OK
D = 0.75
k = 0.09
124 70%
2 1%
50 28%
19% 81% 0%
218 923 5
14 14
OK 16
D = 0.65
k = 0.07
755
OK
765 755
1146
-8
D = 0.60
k = 0.08
OK
1154 1140
OK
755
1154
13 715 27
2% 95% 4%
96% 74
0% 0
4% 3
21 OK
21 21
OK 79
77 77
Staunton Dr
Staunton Dr
60 60
58 OK
D = 0.74
k = 0.06
27 45%
1 2%
32 53%
1% 99% 0%
8 1053 5
33 33
OK 33
D = 0.70
k = 0.13
750
OK
760 750
1066
OK
1066 1061
SR 120
D = 0.59
k = 0.08

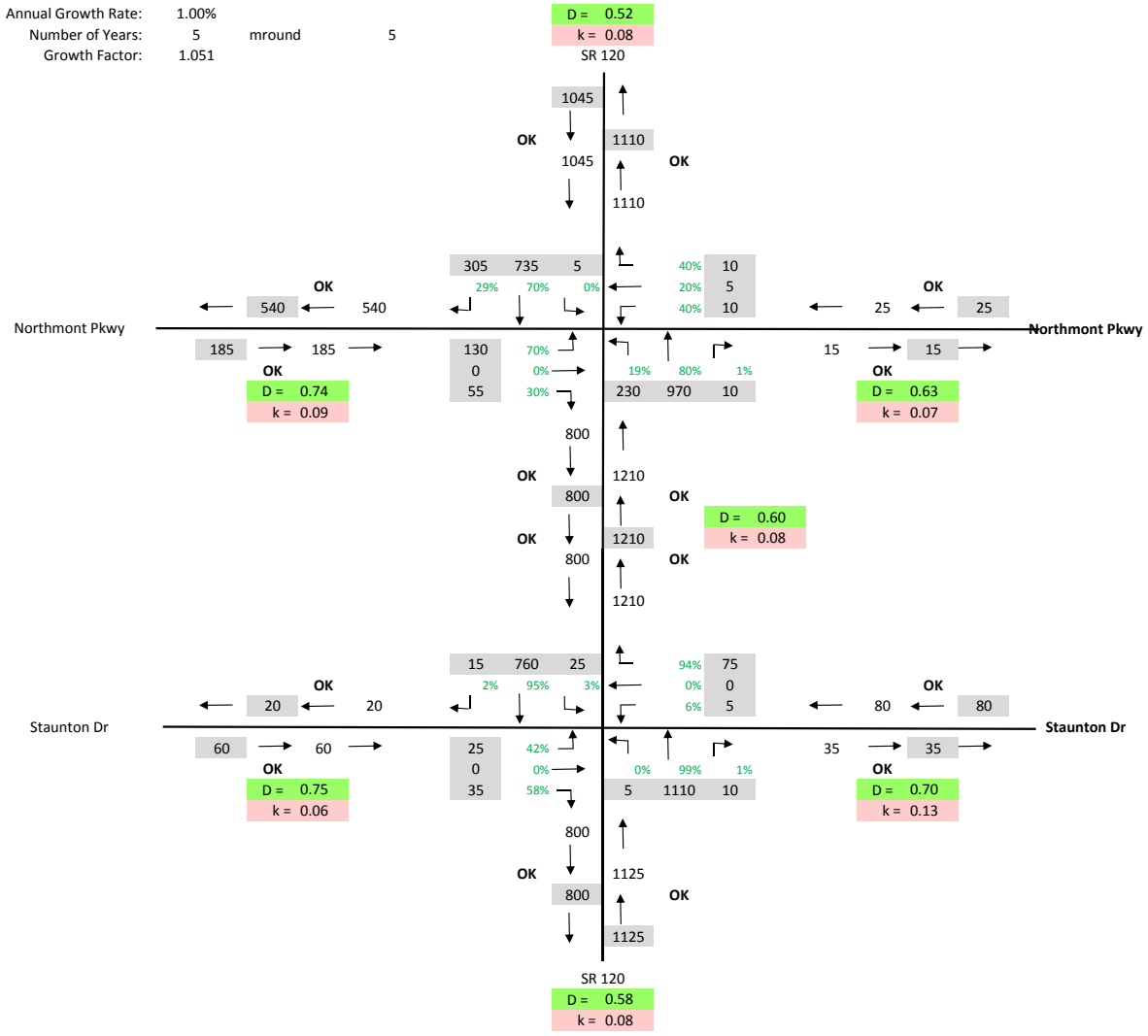

xxx Volumes from ADT Counts
xxx Volumes from TMC Counts
Notes: Hourly Volumes from ADT Counts are consistent with TMC counts.
D = 0.51
k = 0.08
SR 120
998 1031
OK
1031
995 988
OK
995
147 877 7
14% 85% 1%
36% 5
7% 1
57% 8
269 OK
261 261
OK 20
14 14
Northmont Pkwy
Northmont Pkwy
476 476
477 OK
D = 0.65
k = 0.10
251 53%
3 1%
222 47%
13% 85% 2%
113 739 18
28 28
OK 26
D = 0.67
k = 0.07
1107
OK
1100 1107
-17
1090
870
OK
870 867
-2
872
D = 0.56
k = 0.08
15 1050 25
1% 96% 2%
87% 26
3% 1
10% 3
43 OK
41 41
OK 27
30 30
Staunton Dr
Staunton Dr
43 43
44 OK
D = 0.51
k = 0.06
14 33%
2 5%
27 63%
3% 97% 0%
25 832 3
30 30
OK 29
D = 0.50
k = 0.07
1080
OK
1092 1080
860
OK
860 860
SR 120
D = 0.56
k = 0.08

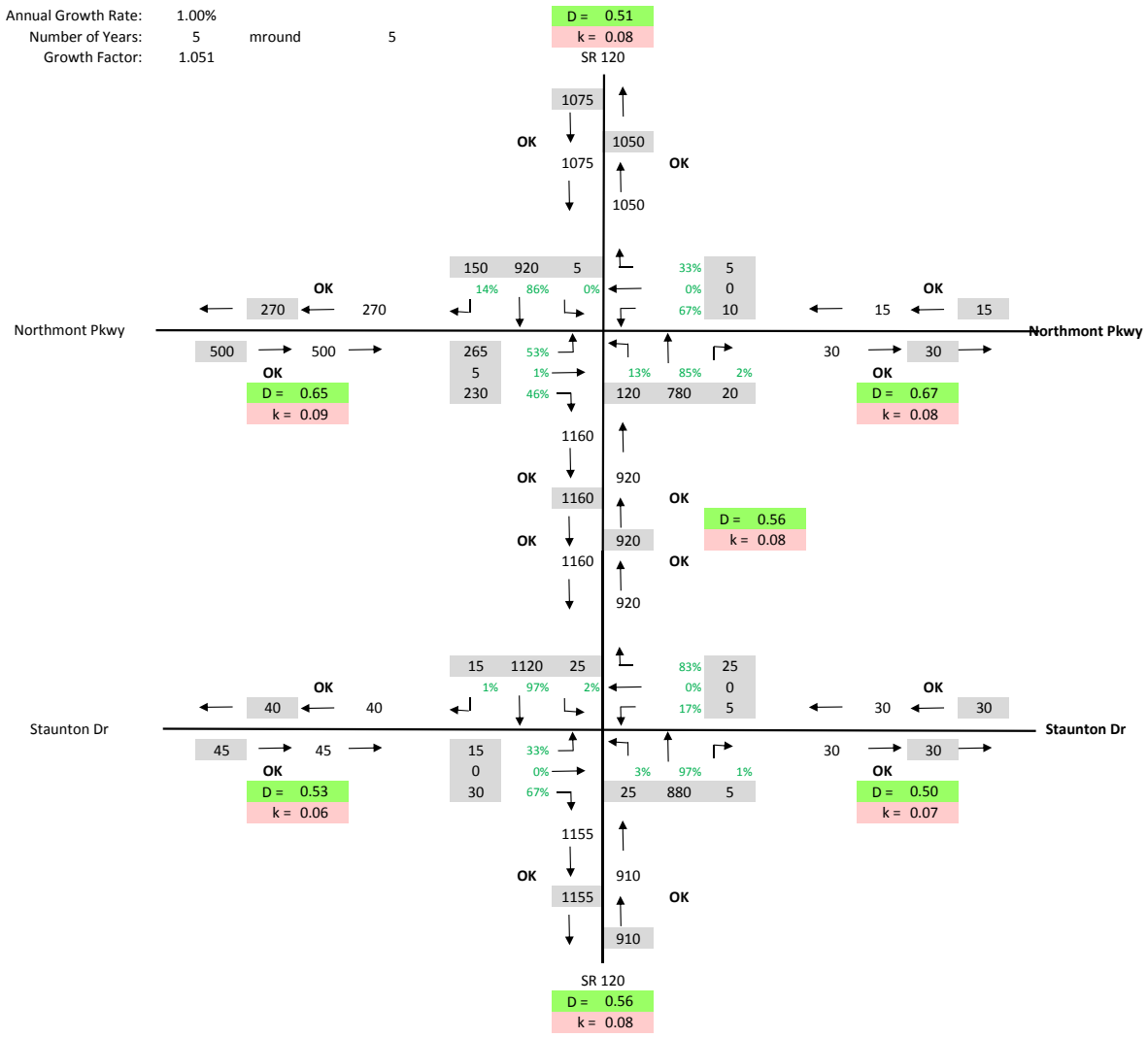

xxx Volumes from ADT Counts
Turning ADT volumes are based off an average between AM and PM TMC turning percentages.
x.x% represents difference between measured ADT and ADT at that location calculated from turning percentages
D = 0.52
SR 120
12986
0.0%
OK
12218
12986
-345
-2.8%
12563
2818
10078
90
41%
116
-16.7%
-695
22%
78%
1%
17%
48
OK
0.0%
4150
4845
42%
119
283
283
Northmont Pkwy
Northmont Pkwy
3594
3595
2214
62%
277
278
0.0%
1
32
1%
16%
83%
1%
1
0.4%
D = 0.54
1349
38%
1979
10233
155
D = 0.50
11546
4.7%
568
12367
12114
OK
0.0%
D = 0.51
0.0%
1
12367
12115
-204
-1.6%
12571
188
11571
356
91%
381
35.9%
234
2%
96%
3%
2%
7
OK
0.0%
652
418
7%
29
417
417
Staunton Dr
Staunton Dr
650
650
252
39%
427
428
0.0%
OK
21
3%
2%
98%
0%
1
0.2%
D = 0.50
377
58%
223
11938
50
D = 0.51
11977
-0.6%
-77
12211
11900
OK
0.0%
12211
D = 0.51

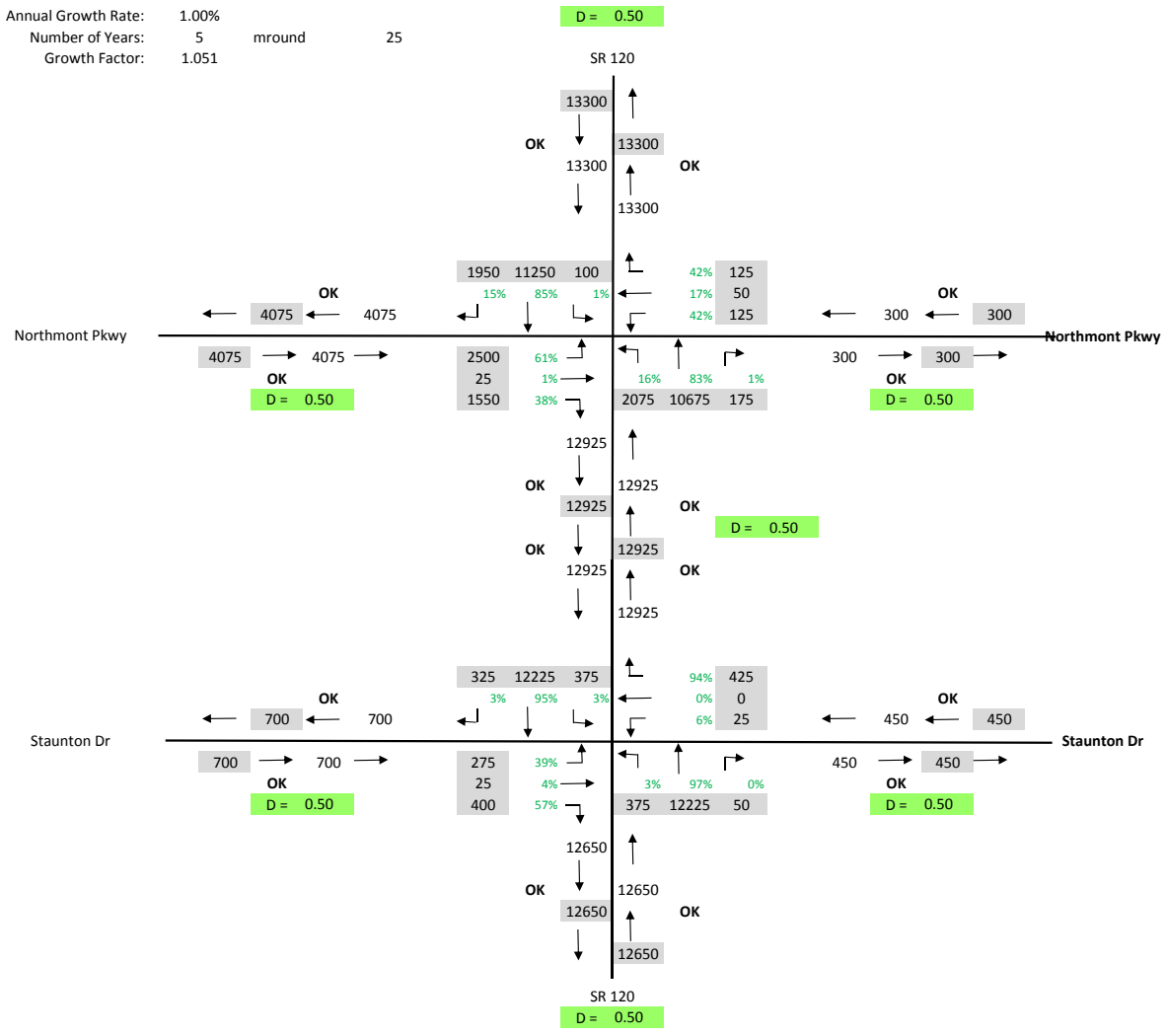

D = 0.51
k = 0.08
Sandy Springs Circle
5 mround value
0
995
OK
1055
-4
995
OK
1055
290
700
5
-2
10
0
2
-2
-2
5
3
10
0
OK
515
515
25
25
OK
-1
Northmont Pkwy
Northmont Pkwy
175
175
15
15
125
1
0
-2
50
0
2
-3
5
220
920
10
-1
OK
D = 0.75
k = 0.09
15
OK
1
D = 0.63
k = 0.07
760
OK
5
760
1150
OK
D = 0.60
k = 0.08
OK
1150
-4
760
OK
1150
15
720
25
-4
70
2
5
-2
0
0
2
5
-1
OK
20
20
75
75
OK
-2
Staunton Dr
Staunton Dr
60
60
25
-2
35
0
-1
3
-3
2
5
5
1055
10
0
OK
D = 0.75
k = 0.06
35
OK
2
D = 0.68
k = 0.13
760
OK
10
760
1070
OK
1070
4
Sandy Springs Circle
D = 0.58
k = 0.08

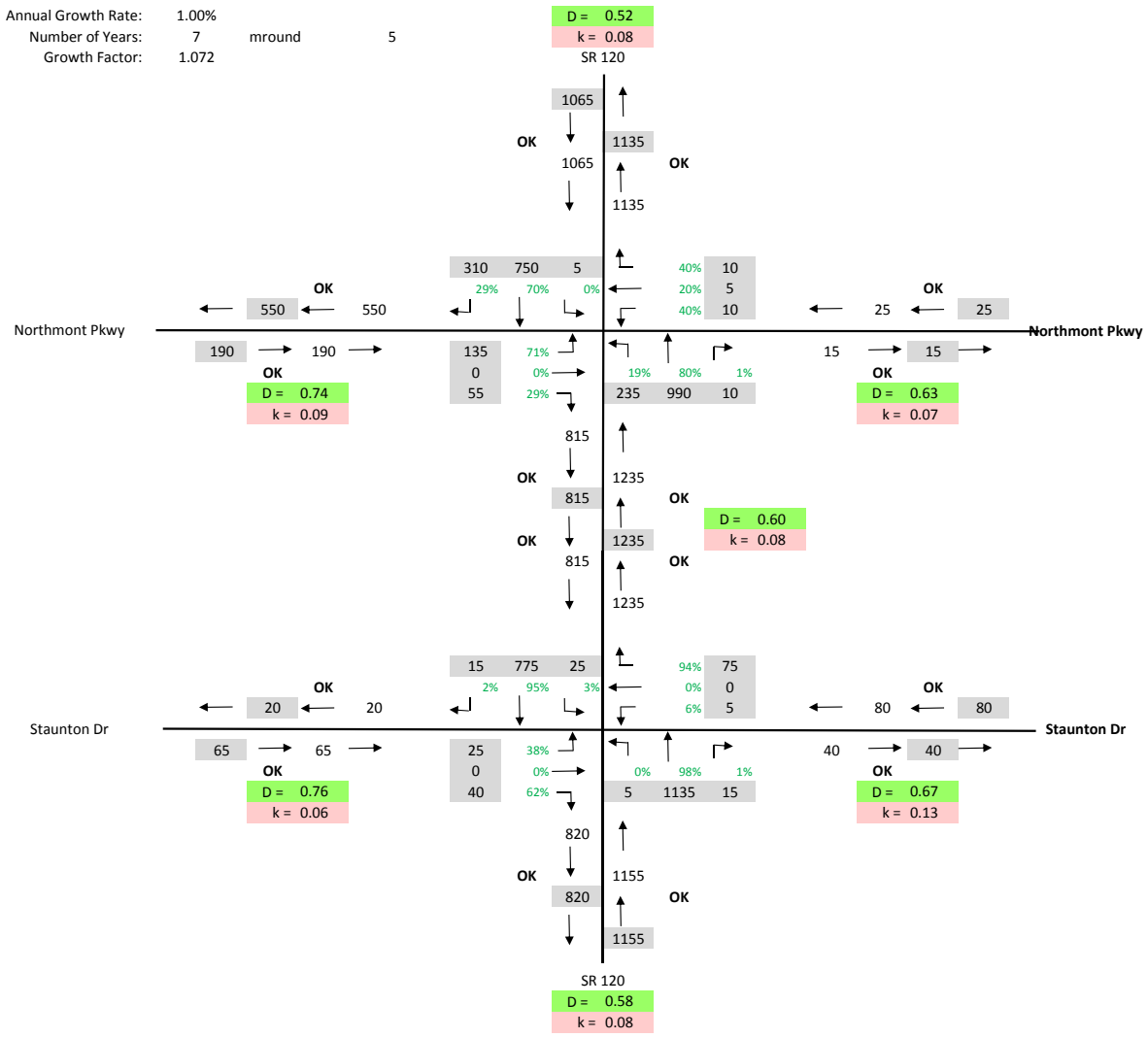

D = 0.51
k = 0.08
SR 120
5 mround value
-6
1025
OK
995
0
1025
OK
995
145
875
5
0
5
-2
-2
-2
-1
0
2
10
-1
OK
260
260
15
OK
1
15
Northmont Pkwy
Northmont Pkwy
475
475
250
-1
30
30
-1
OK
5
2
2
1
2
OK
2
D = 0.65
k = 0.09
220
-2
115
740
20
D = 0.67
k = 0.08
1105
OK
875
OK
-2
1105
OK
D = 0.56
k = 0.08
875
5
OK
1105
OK
875
15
1065
25
-1
25
0
15
0
-1
0
2
5
-1
OK
40
40
30
OK
0
30
Staunton Dr
Staunton Dr
45
45
15
1
30
30
2
OK
0
-2
0
3
2
OK
0
D = 0.53
k = 0.07
30
3
25
835
5
D = 0.50
k = 0.07
1100
OK
865
20
1100
OK
865
5
SR 120
D = 0.56
k = 0.08

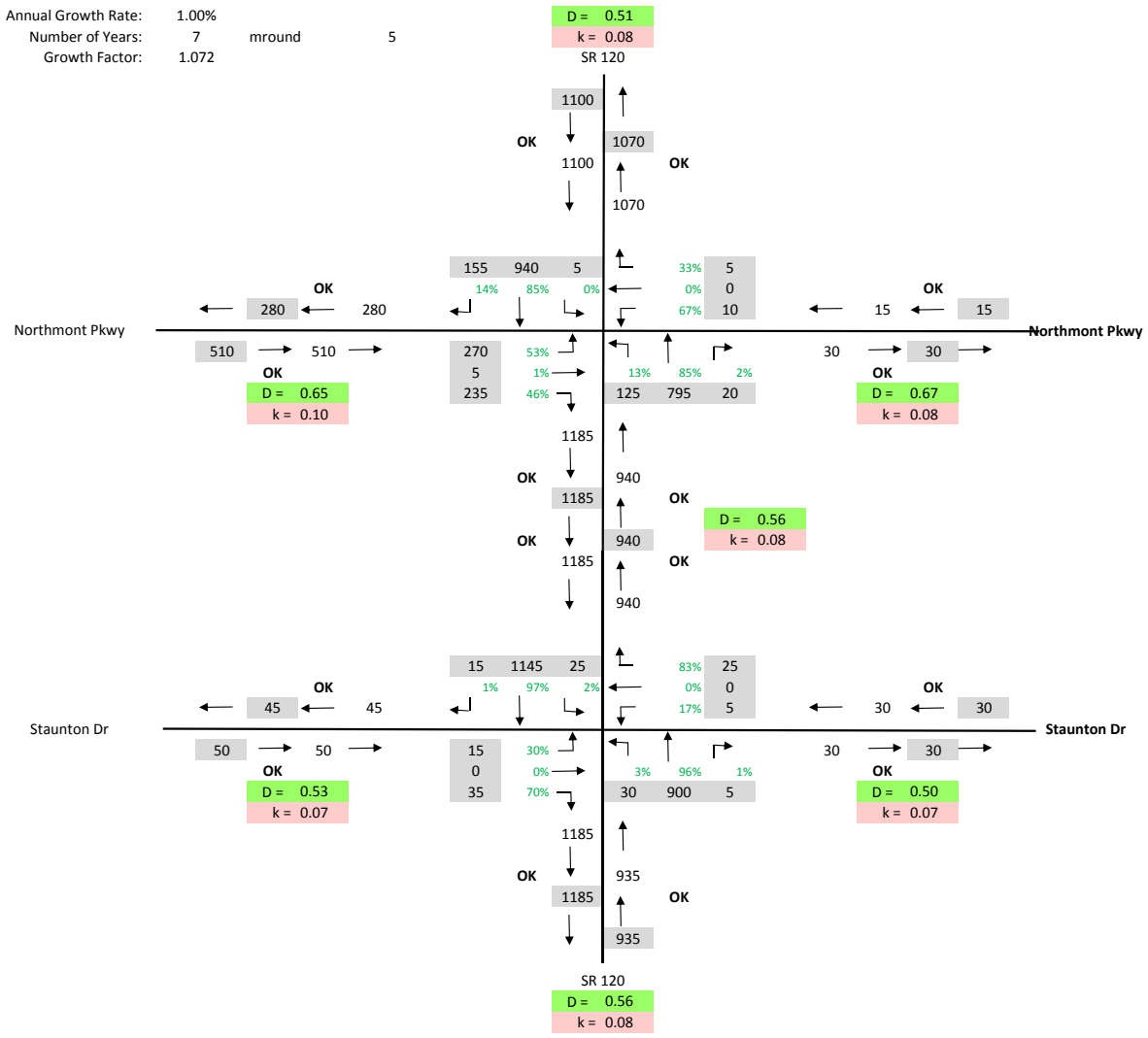

D = 0.50
25 mround value
SR 120
-336
12650
OK
12650
432
12650
OK
12650
22%
78%
1%
1850
10700
100
9
125
41%
-275
OK
-968
622
10
2
50
17%
OK
-8
3875
3875
-19
100
42%
275
275
Northmont Pkwy
Northmont Pkwy
3875
3875
62%
2375
161
-4
-83
-5
275
275
281
OK
1%
25
-7
OK
-3
D = 0.50
38%
1475
126
1975
10150
150
D = 0.50
16%
83%
1%
12275
OK
12275
OK
161
12275
OK
D = 0.50
OK
12275
-92
12275
OK
12275
2%
96%
3%
300
11625
350
19
400
91%
-2
OK
112
54
-6
-7
0
2%
OK
8
650
650
-4
25
7%
425
425
Staunton Dr
Staunton Dr
650
650
39%
250
-2
127
-313
0
425
425
0
OK
3%
25
4
OK
-3
D = 0.50
58%
375
-2
350
11625
50
D = 0.50
2%
98%
0%
12025
OK
12025
OK
125
12025
OK
12025
-186
SR 120
D = 0.50

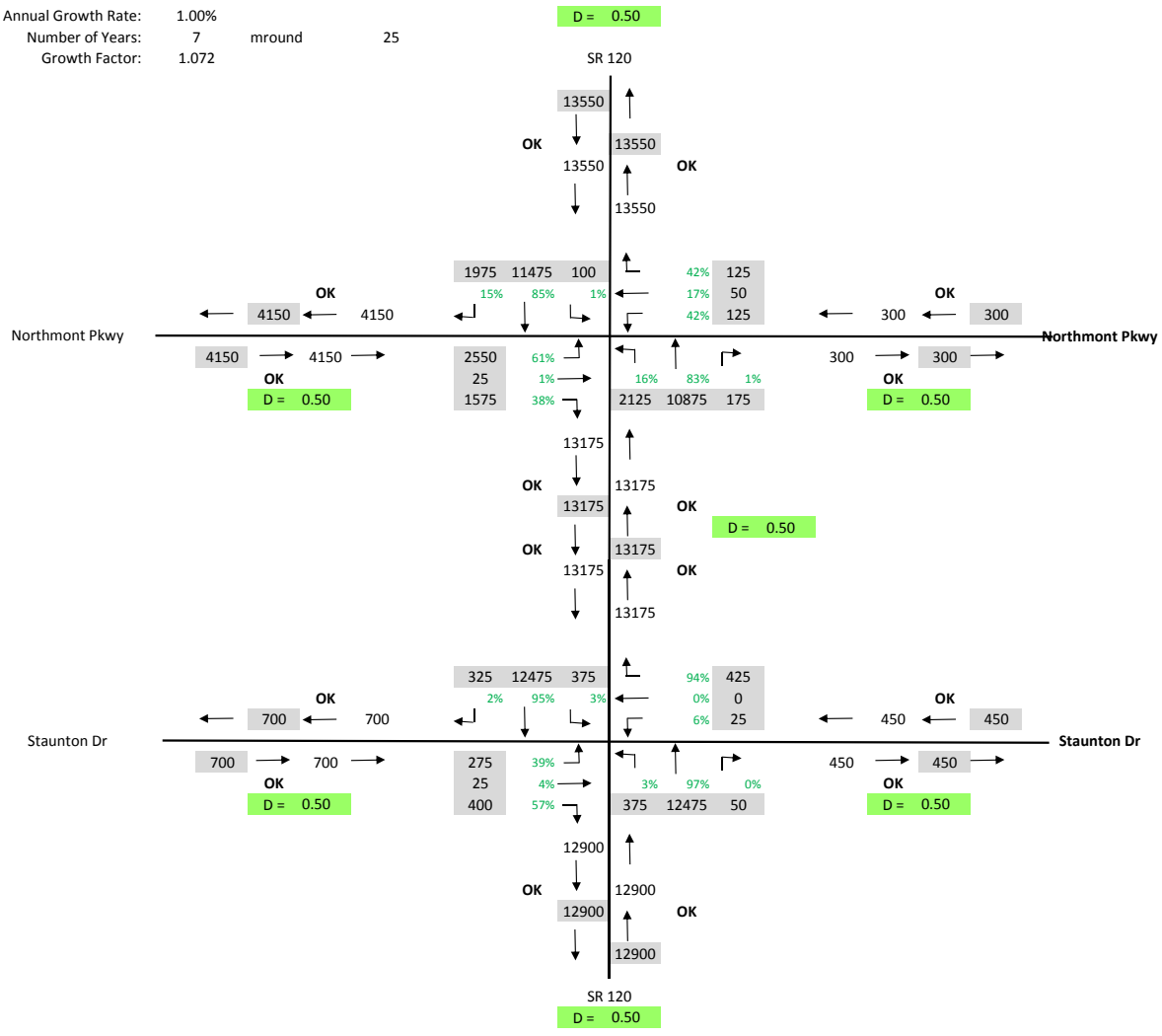

Annual Growth Rate: 1.00%
Number of Years: 5 mround 5
Growth Factor: 1.051
D = 0.52
k = 0.08
SR 120
1045
OK
1110
1045
OK
1110
305 735 5
29% 70% 0%
40% 10
20% 5
40% 10
OK
540 540
OK
25 25
Northmont Pkwy
Northmont Pkwy
185 185
130
0
55
70%
0%
30%
19% 80% 1%
230 970 10
15 15
OK
D = 0.74
k = 0.09
OK
D = 0.63
k = 0.07
800
OK
1210
800
OK
1210
OK
D = 0.60
k = 0.08
800
OK
1210
15 760 25
2% 95% 3%
94% 75
0% 0
6% 5
OK
20 20
OK
80 80
Staunton Dr
Staunton Dr
60 60
25
0
35
42%
0%
58%
0% 99% 1%
5 1110 10
35 35
OK
D = 0.75
k = 0.06
OK
D = 0.70
k = 0.13
800
OK
1125
800
OK
1125
SR 120
D = 0.58
k = 0.08

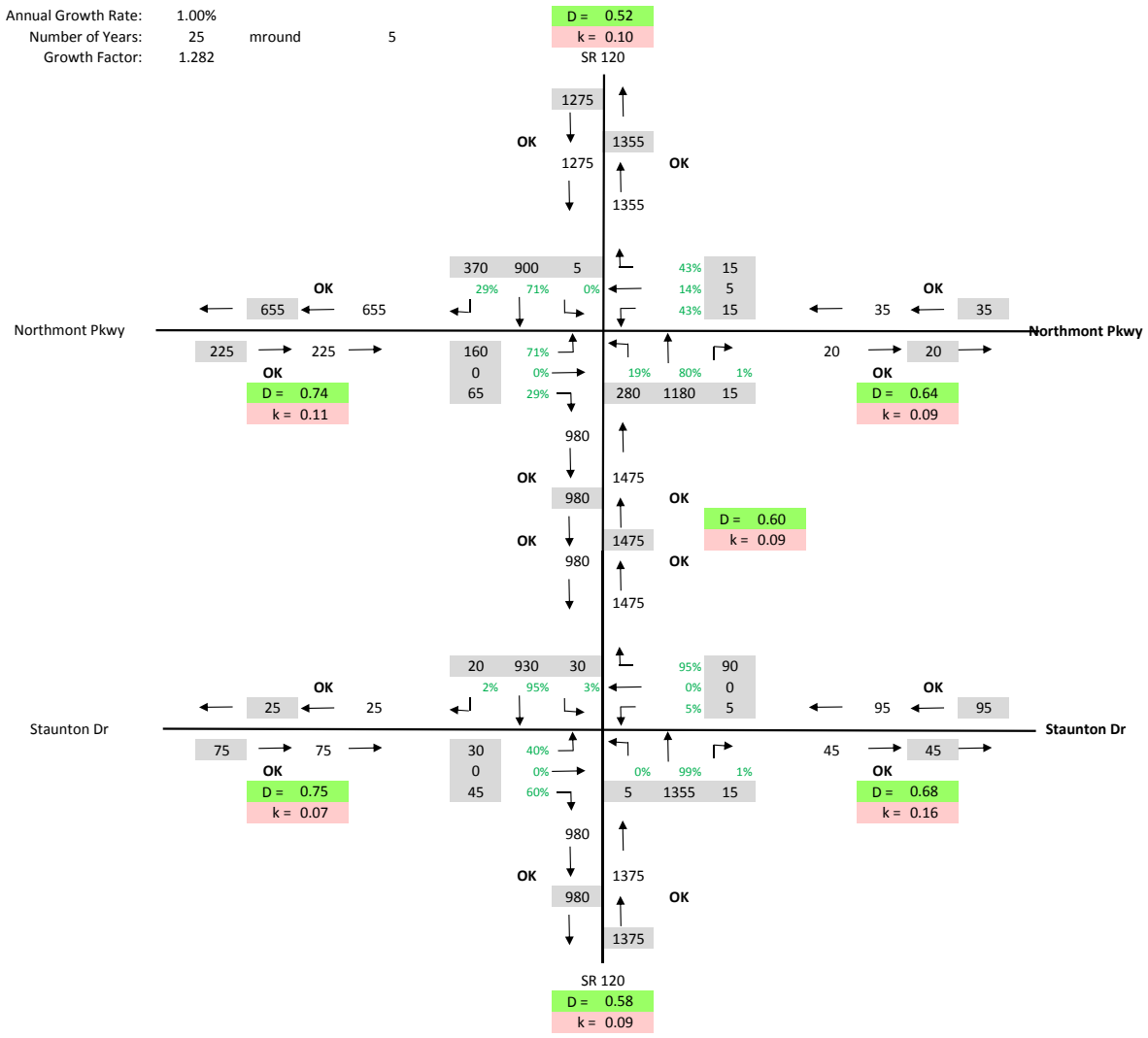

Annual Growth Rate: 1.00%
Number of Years: 5 mround 5
Growth Factor: 1.051
D = 0.51
k = 0.08
SR 120
1075
OK
1050
1075
OK
1050
150 920 5
14% 86% 0%
33% 5
0% 0
67% 10
OK
270 270
OK
15 15
Northmont Pkwy
Northmont Pkwy
500 500
265
5
230
53%
1%
46%
13% 85% 2%
120 780 20
30 30
OK
D = 0.65
k = 0.09
OK
D = 0.67
k = 0.08
1160
OK
920
1160
OK
920
D = 0.56
k = 0.08
OK
1160
OK
920
15 1120 25
1% 97% 2%
83% 25
0% 0
17% 5
OK
40 40
OK
30 30
Staunton Dr
Staunton Dr
45 45
15
0
30
33%
0%
67%
3% 97% 1%
25 880 5
30 30
OK
D = 0.53
k = 0.06
OK
D = 0.50
k = 0.07
1155
OK
910
1155
OK
910
SR 120
D = 0.56
k = 0.08

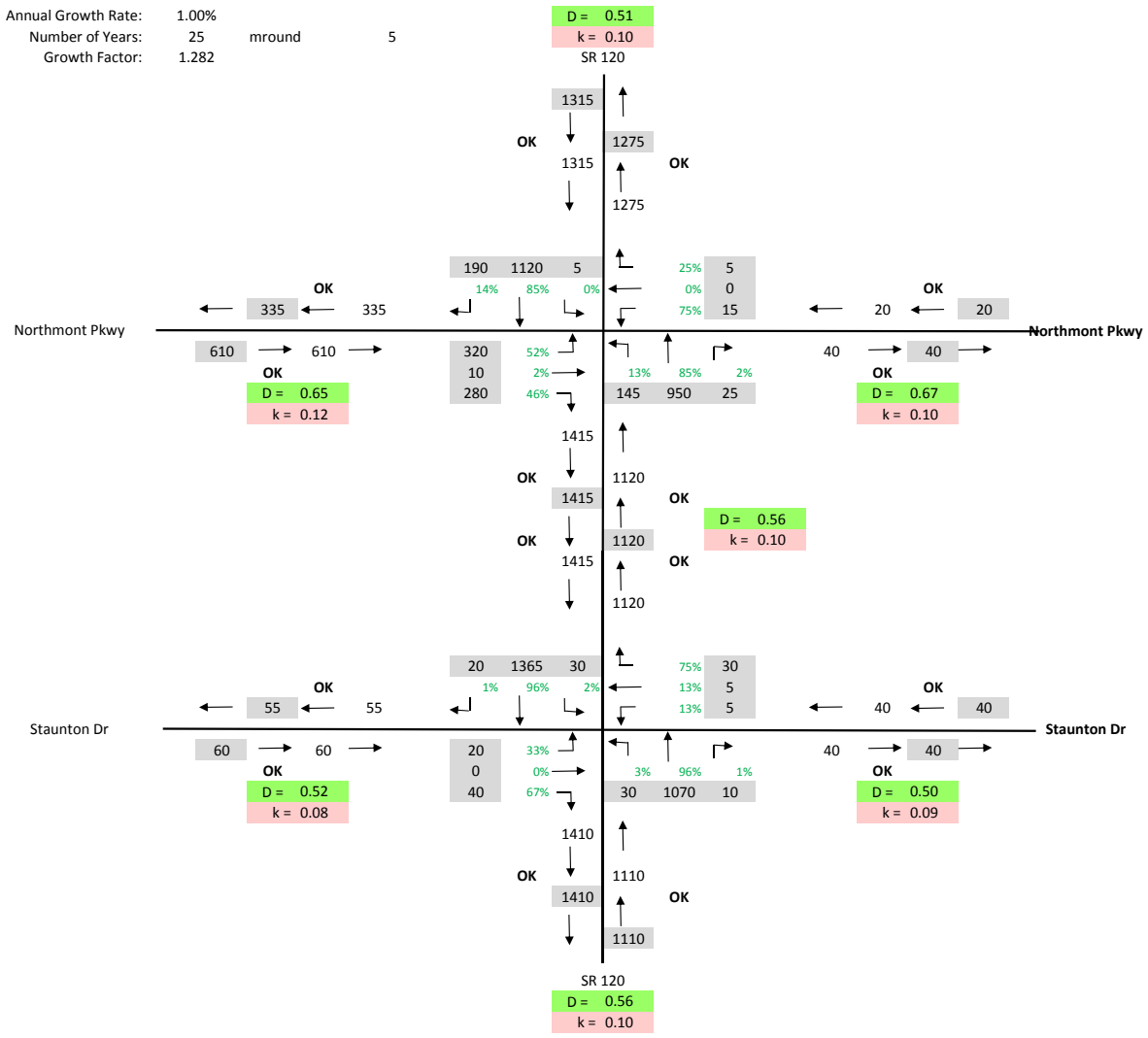

Annual Growth Rate: 1.00%
Number of Years: 5 mround 25
Growth Factor: 1.051
D = 0.50
SR 120
13300
OK
13300
13300
OK
13300
1950 11250 100
15% 85% 1%
42% 125
17% 50
42% 125
OK
4075 4075
OK
300 300
OK
Northmont Pkwy
Northmont Pkwy
4075 4075
2500 61%
25 1%
1550 38%
16% 83% 1%
2075 10675 175
300 300
OK
D = 0.50
OK
D = 0.50
12925
OK
12925
12925
OK
D = 0.50
OK
12925
12925
OK
12925
325 12225 375
3% 95% 3%
94% 425
0% 0
6% 25
OK
700 700
OK
450 450
OK
Staunton Dr
Staunton Dr
700 700
275 39%
25 4%
400 57%
3% 97% 0%
375 12225 50
450 450
OK
D = 0.50
OK
D = 0.50
12650
OK
12650
12650
OK
12650
SR 120
D = 0.50

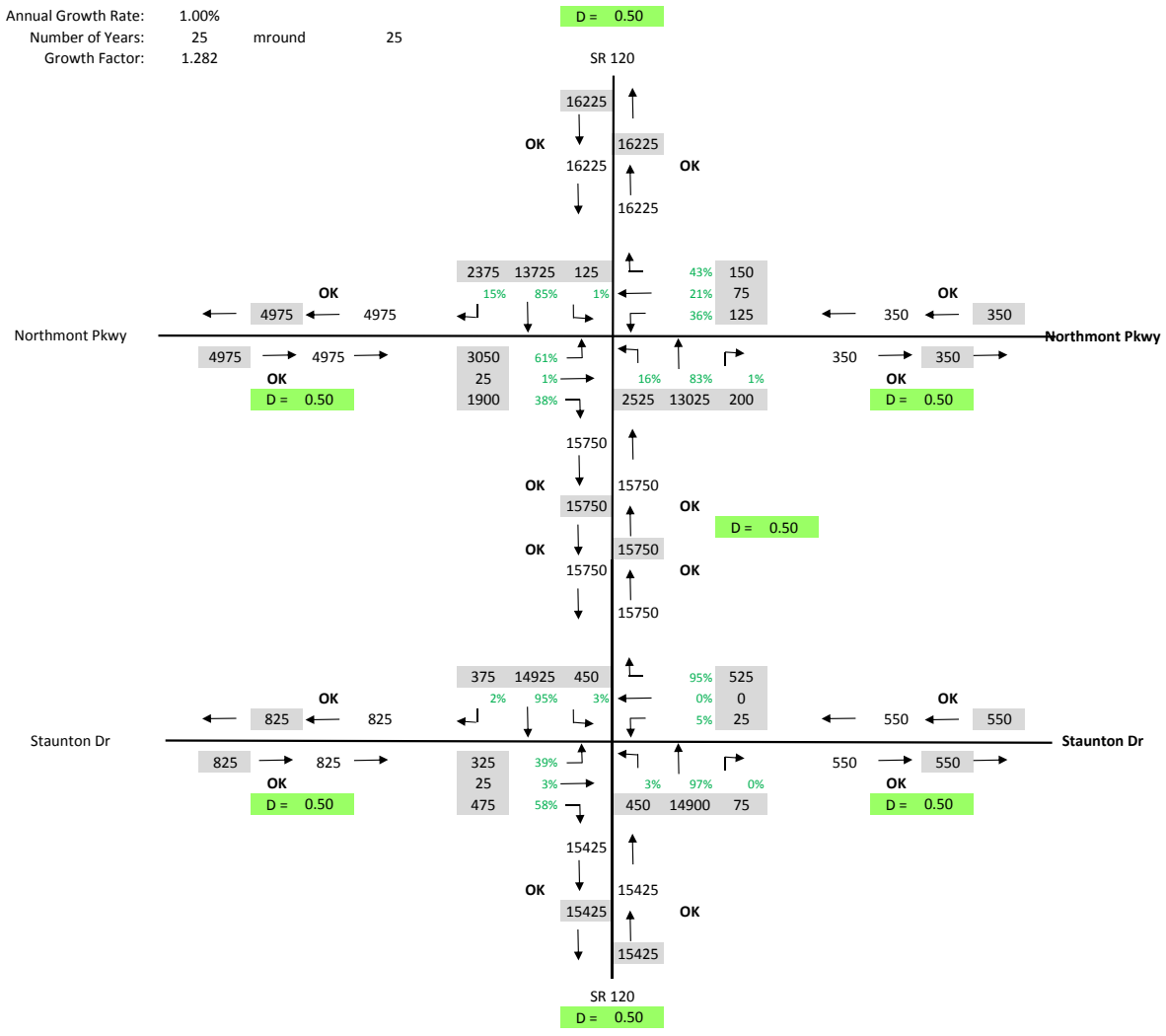

Annual Growth Rate: 1.00%
Number of Years: 7 mround 5
Growth Factor: 1.072
D = 0.52
k = 0.08
SR 120
1065
OK
1135
1065
OK
1135
310 750 5
29% 70% 0%
40% 10
20% 5
40% 10
OK
550 550
OK
25 25
Northmont Pkwy
Northmont Pkwy
190 190
135
0
55
71%
0%
29%
19% 80% 1%
235 990 10
15 15
OK
D = 0.74
k = 0.09
OK
D = 0.63
k = 0.07
815
OK
1235
815
OK
1235
D = 0.60
k = 0.08
OK
815
OK
1235
15 775 25
2% 95% 3%
94% 75
0% 0
6% 5
OK
20 20
OK
80 80
Staunton Dr
Staunton Dr
65 65
25
0
40
38%
0%
62%
0% 98% 1%
5 1135 15
40 40
OK
D = 0.76
k = 0.06
OK
D = 0.67
k = 0.13
820
OK
1155
820
OK
1155
SR 120
D = 0.58
k = 0.08

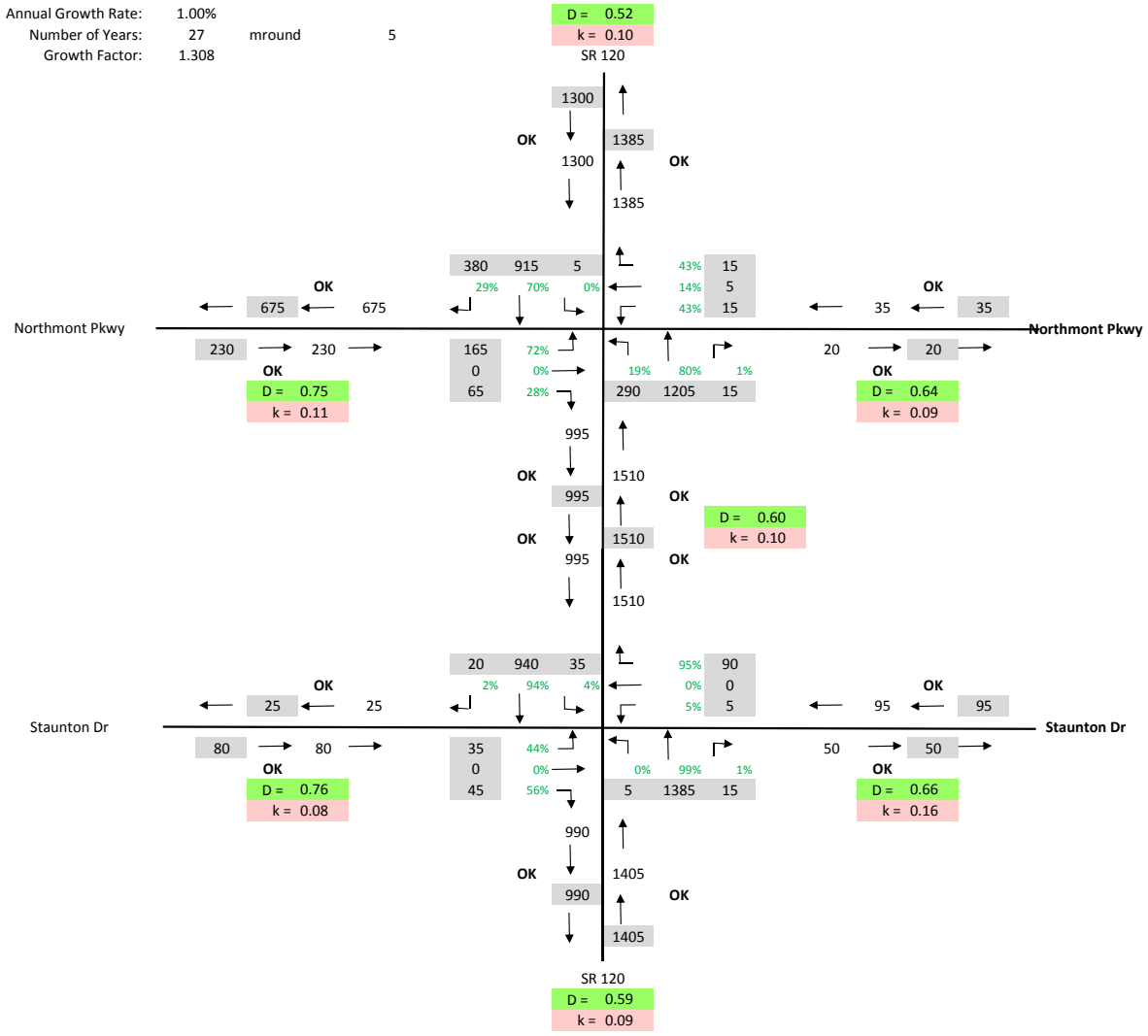

Annual Growth Rate: 1.00%
Number of Years: 7 mround 5
Growth Factor: 1.072
D = 0.51
k = 0.08
SR 120
1100
OK
1070
1100
OK
1070
155 940 5
14% 85% 0%
33% 5
0% 0
67% 10
OK
280 280
OK
15 15
Northmont Pkwy
Northmont Pkwy
510 510
270 53%
5 1%
235 46%
13% 85% 2%
125 795 20
30 30
OK
D = 0.65
k = 0.10
OK
D = 0.67
k = 0.08
1185
OK
940
1185
OK
940
D = 0.56
k = 0.08
OK
1185
OK
940
15 1145 25
1% 97% 2%
83% 25
0% 0
17% 5
OK
45 45
OK
30 30
Staunton Dr
Staunton Dr
50 50
15 30%
0 0%
35 70%
3% 96% 1%
30 900 5
30 30
OK
D = 0.53
k = 0.07
OK
D = 0.50
k = 0.07
1185
OK
935
1185
OK
935
SR 120
D = 0.56
k = 0.08

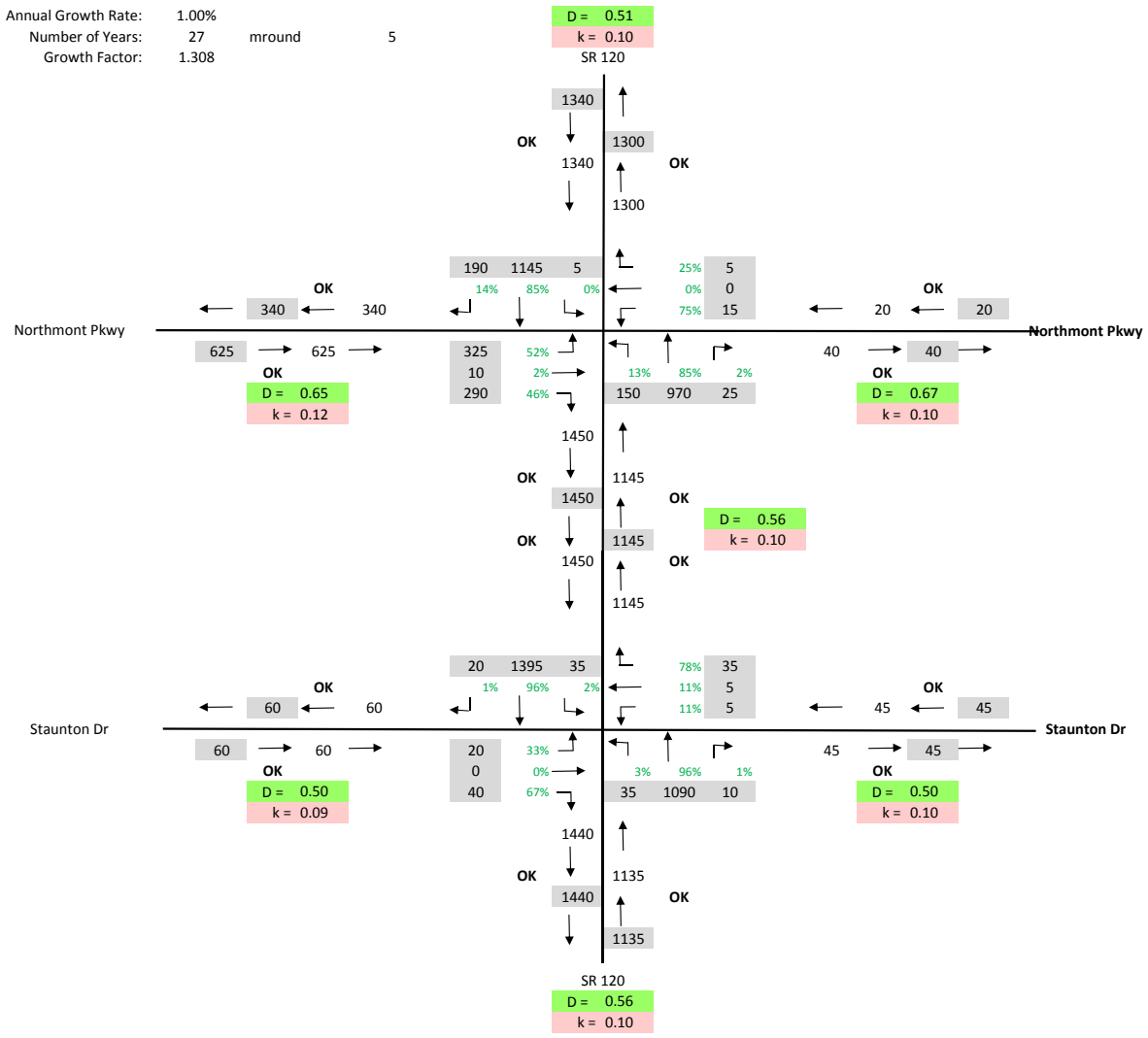

Annual Growth Rate: 1.00%
Number of Years: 7 mround 25
Growth Factor: 1.072
D = 0.50
SR 120
13550
OK
13550
13550
OK
13550
1975 11475 100
15% 85% 1%
42% 125
17% 50
42% 125
OK
4150 4150
OK
300 300
OK
Northmont Pkwy
Northmont Pkwy
4150 4150
2550 61%
25 1%
1575 38%
16% 83% 1%
2125 10875 175
300 300
OK
D = 0.50
OK
D = 0.50
13175
OK
13175
13175
OK
D = 0.50
OK
13175
13175
OK
13175
325 12475 375
2% 95% 3%
94% 425
0% 0
6% 25
OK
700 700
OK
450 450
OK
Staunton Dr
Staunton Dr
700 700
275 39%
25 4%
400 57%
3% 97% 0%
375 12475 50
450 450
OK
D = 0.50
OK
D = 0.50
12900
OK
12900
12900
OK
12900
SR 120
D = 0.50


Annual Growth Rate: 1.00%
Number of Years: 25 mround 5
Growth Factor: 1.282
D = 0.52
k = 0.10
SR 120
1275
OK
1355
1275
OK
1355
370 900 5
29% 71% 0%
43% 15
14% 5
43% 15
OK
655 655
OK
35 35
Northmont Pkwy
Northmont Pkwy
225 225
160 71%
0 0%
65 29%
19% 80% 1%
280 1180 15
20 20
OK
D = 0.74
k = 0.11
OK
D = 0.64
k = 0.09
980
OK
1475
980
OK
1475
D = 0.60
k = 0.09
OK
980
OK
1475
20 930 30
2% 95% 3%
95% 90
0% 0
5% 5
OK
25 25
OK
95 95
Staunton Dr
Staunton Dr
75 75
30 40%
0 0%
45 60%
0% 99% 1%
5 1355 15
45 45
OK
D = 0.75
k = 0.07
OK
D = 0.68
k = 0.16
980
OK
1375
980
OK
1375
SR 120
D = 0.58
k = 0.09

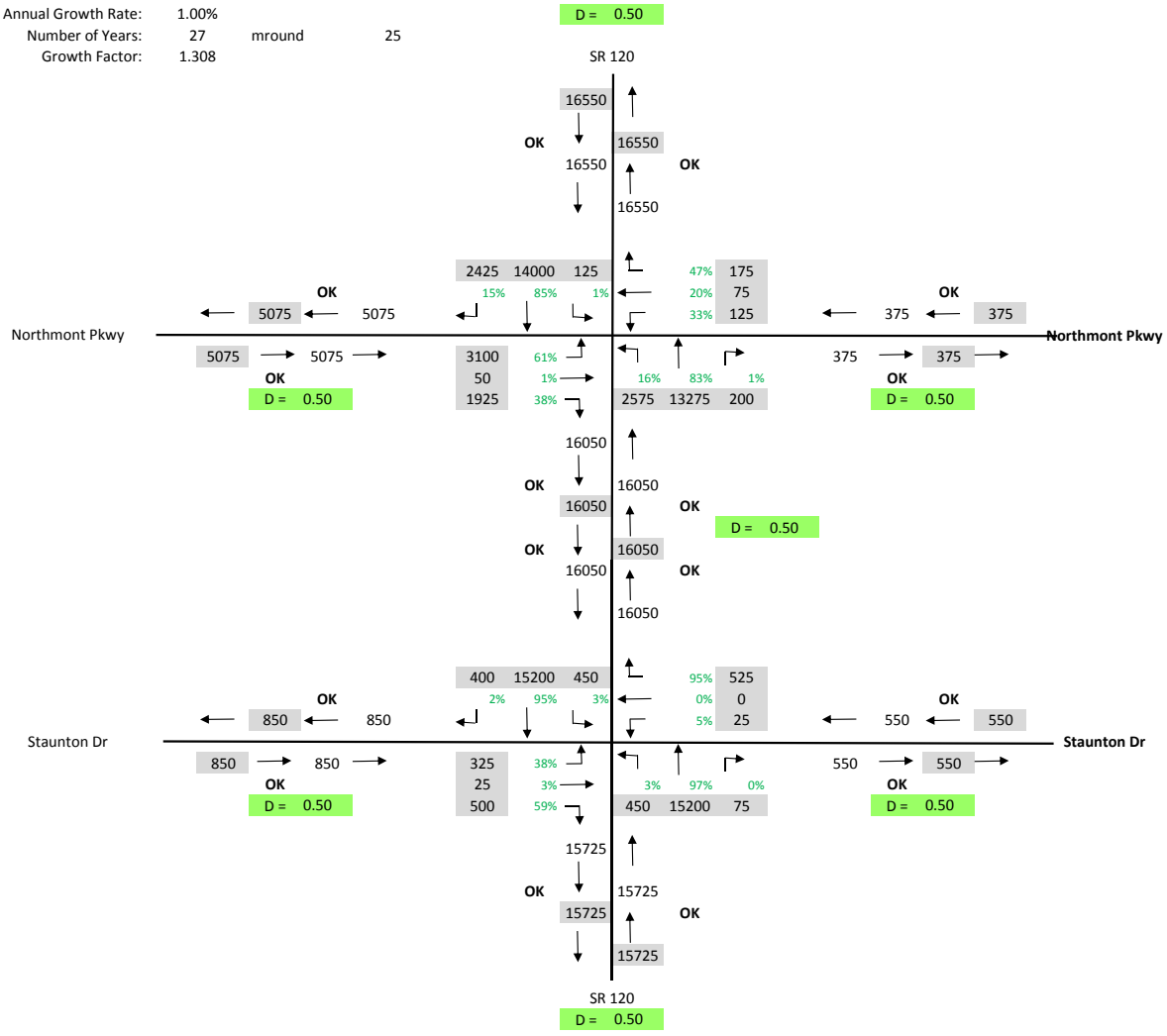

Annual Growth Rate: 1.00%
Number of Years: 25 mround 5
Growth Factor: 1.282
D = 0.51
k = 0.10
SR 120
1315
OK
1275
1315
OK
1275
190 1120 5
14% 85% 0%
25% 5
0% 0
75% 15
OK
335 335
OK
20 20
Northmont Pkwy
Northmont Pkwy
610 610
320 52%
10 2%
280 46%
13% 85% 2%
145 950 25
40 40
OK
D = 0.65
k = 0.12
OK
D = 0.67
k = 0.10
1415
OK
1120
1415
OK
1120
D = 0.56
k = 0.10
OK
1415
OK
1120
20 1365 30
1% 96% 2%
75% 30
13% 5
13% 5
OK
55 55
OK
40 40
Staunton Dr
Staunton Dr
60 60
20 33%
0 0%
40 67%
3% 96% 1%
30 1070 10
40 40
OK
D = 0.52
k = 0.08
OK
D = 0.50
k = 0.09
1410
OK
1110
1410
OK
1110
SR 120
D = 0.56
k = 0.10


Annual Growth Rate: 1.00%
Number of Years: 25 mround 25
Growth Factor: 1.282
D = 0.50
SR 120
16225
OK
16225
16225
OK
16225
2375 13725 125
15% 85% 1%
43% 150
21% 75
36% 125
OK
4975 4975
OK
350 350
Northmont Pkwy
Northmont Pkwy
4975 4975
3050 61%
25 1%
1900 38%
16% 83% 1%
2525 13025 200
350 350
OK
D = 0.50
OK
D = 0.50
15750
OK
15750
15750
OK
D = 0.50
OK
15750
15750
OK
15750
375 14925 450
2% 95% 3%
95% 525
0% 0
5% 25
OK
825 825
OK
550 550
Staunton Dr
Staunton Dr
825 825
325 39%
25 3%
475 58%
3% 97% 0%
450 14900 75
550 550
OK
D = 0.50
OK
D = 0.50
15425
OK
15425
15425
OK
15425
SR 120
D = 0.50


Annual Growth Rate: 1.00%
Number of Years: 27 mround 5
Growth Factor: 1.308
D = 0.52
k = 0.10
SR 120
1300
OK
1385
1300
OK
1385
380 915 5
29% 70% 0%
43% 15
14% 5
43% 15
OK
675 675
35 35
OK
Northmont Pkwy
Northmont Pkwy
230 230
165
0
65
72%
0%
28%
19% 80% 1%
290 1205 15
20 20
OK
D = 0.75
k = 0.11
OK
D = 0.64
k = 0.09
995
OK
1510
995
OK
1510
D = 0.60
k = 0.10
OK
995
OK
1510
20 940 35
2% 94% 4%
95% 90
0% 0
5% 5
OK
25 25
OK
95 95
Staunton Dr
Staunton Dr
80 80
35
0
45
44%
0%
56%
0% 99% 1%
5 1385 15
50 50
OK
D = 0.76
k = 0.08
OK
D = 0.66
k = 0.16
990
OK
1405
990
OK
1405
SR 120
D = 0.59
k = 0.09

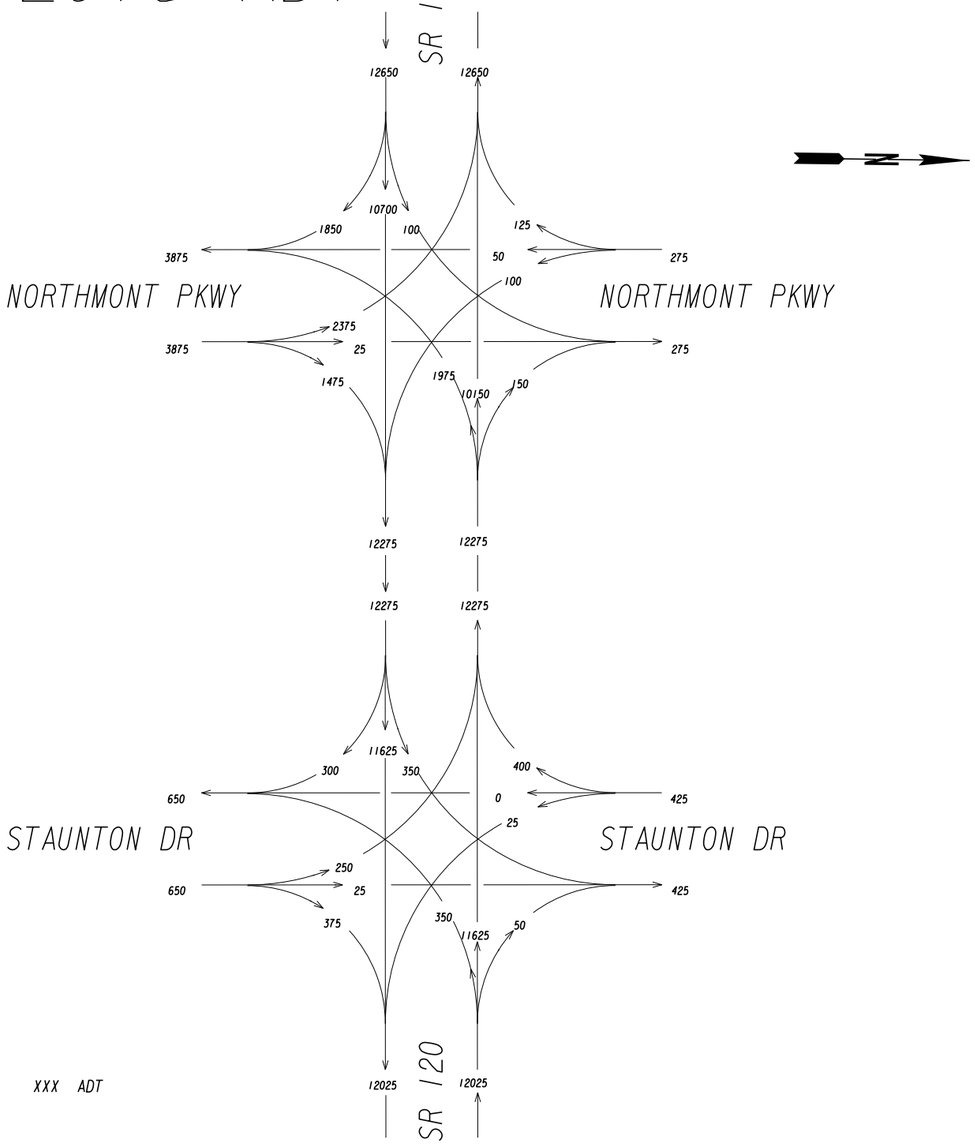

Annual Growth Rate: 1.00%
Number of Years: 27 mround 5
Growth Factor: 1.308
D = 0.51
k = 0.10
SR 120
1340
OK
1300
1340
OK
1300
190 1145 5
14% 85% 0%
25% 5
0% 0
75% 15
OK
340 340
OK
20 20
Northmont Pkwy
Northmont Pkwy
625 625
325 52%
10 2%
290 46%
13% 85% 2%
150 970 25
40 40
OK
D = 0.65
k = 0.12
OK
D = 0.67
k = 0.10
1450
OK
1145
1450
OK
1145
OK
D = 0.56
k = 0.10
1450
OK
1145
20 1395 35
1% 96% 2%
78% 35
11% 5
11% 5
OK
60 60
OK
45 45
Staunton Dr
Staunton Dr
60 60
20 33%
0 0%
40 67%
3% 96% 1%
35 1090 10
45 45
OK
D = 0.50
k = 0.09
OK
D = 0.50
k = 0.10
1440
OK
1135
1440
OK
1135
SR 120
D = 0.56
k = 0.10

Annual Growth Rate:	1.00%		
Number of Years:	27	mround	25
Growth Factor:	1.308		



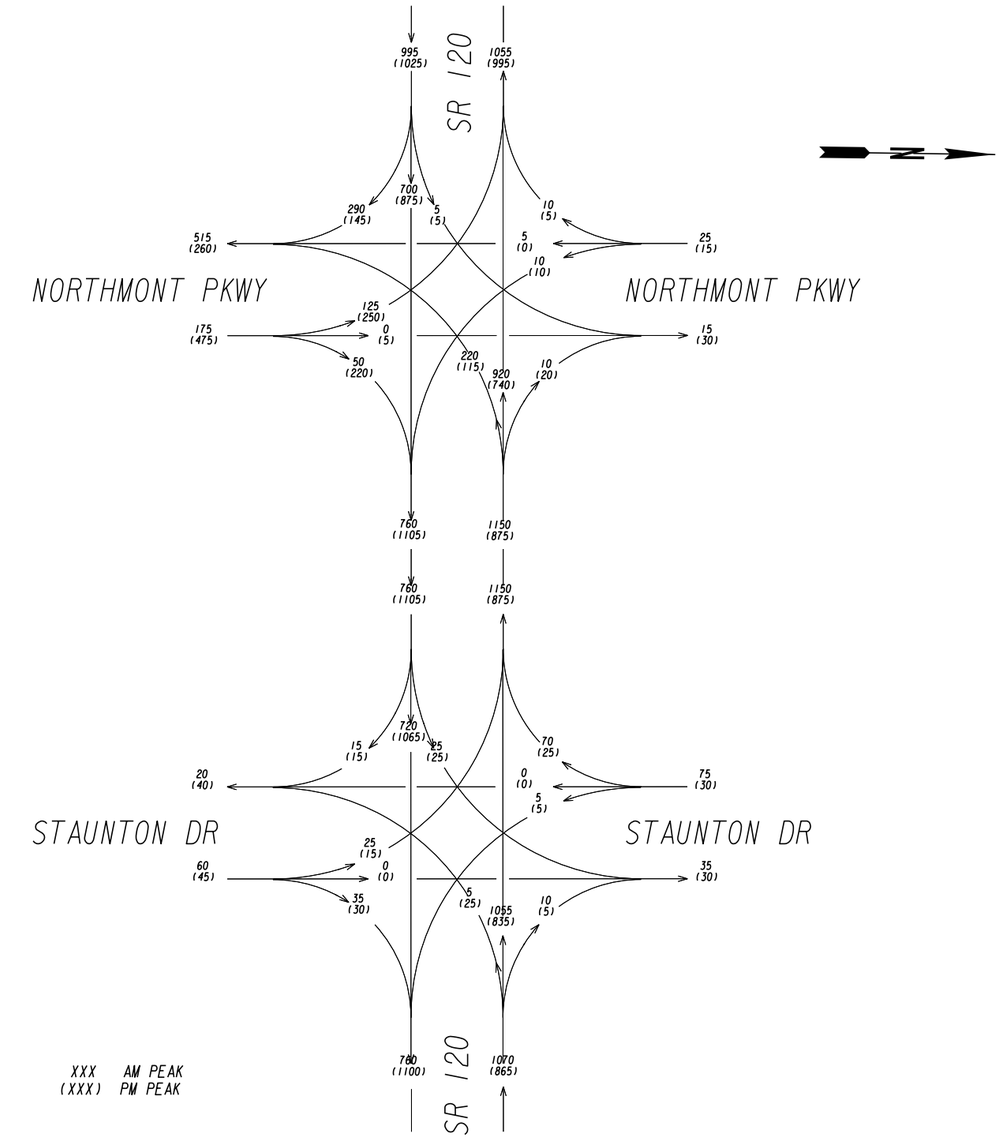
Appendix E: Design Traffic

2015 ADT



Daily Trucks		
Single Unit	Combination	Total
7.0%	1.0%	8.0%

2015 PEAK HOUR



Peak Hour Trucks		
Single Unit	Combination	Total
8.0%	1.0%	9.0%

PI 0132986
GWINNETT COUNTY
AUGUST 11, 2015
WMR/KMC

01/26/2015 GPLN

Michael Baker INTERNATIONAL
3595 ENGINEERING DRIVE
NORCROSS, GEORGIA 30092
(770) 263-9118

GEORGIA
DEPARTMENT OF TRANSPORTATION

REVISION DATES

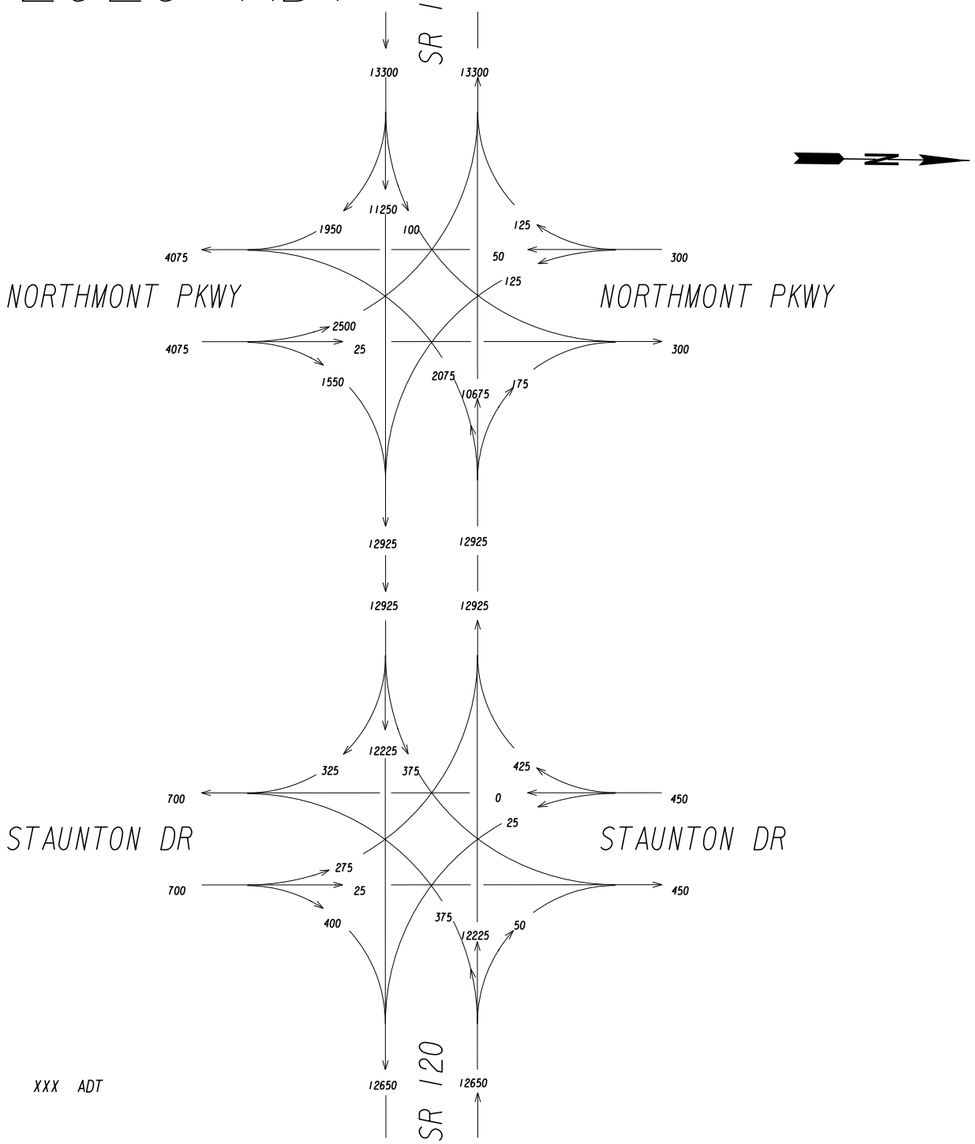
STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE:

TRAFFIC DIAGRAM

SR 120 AT SINGLETON CREEK

DRAWING No. 10-001

2020 ADT

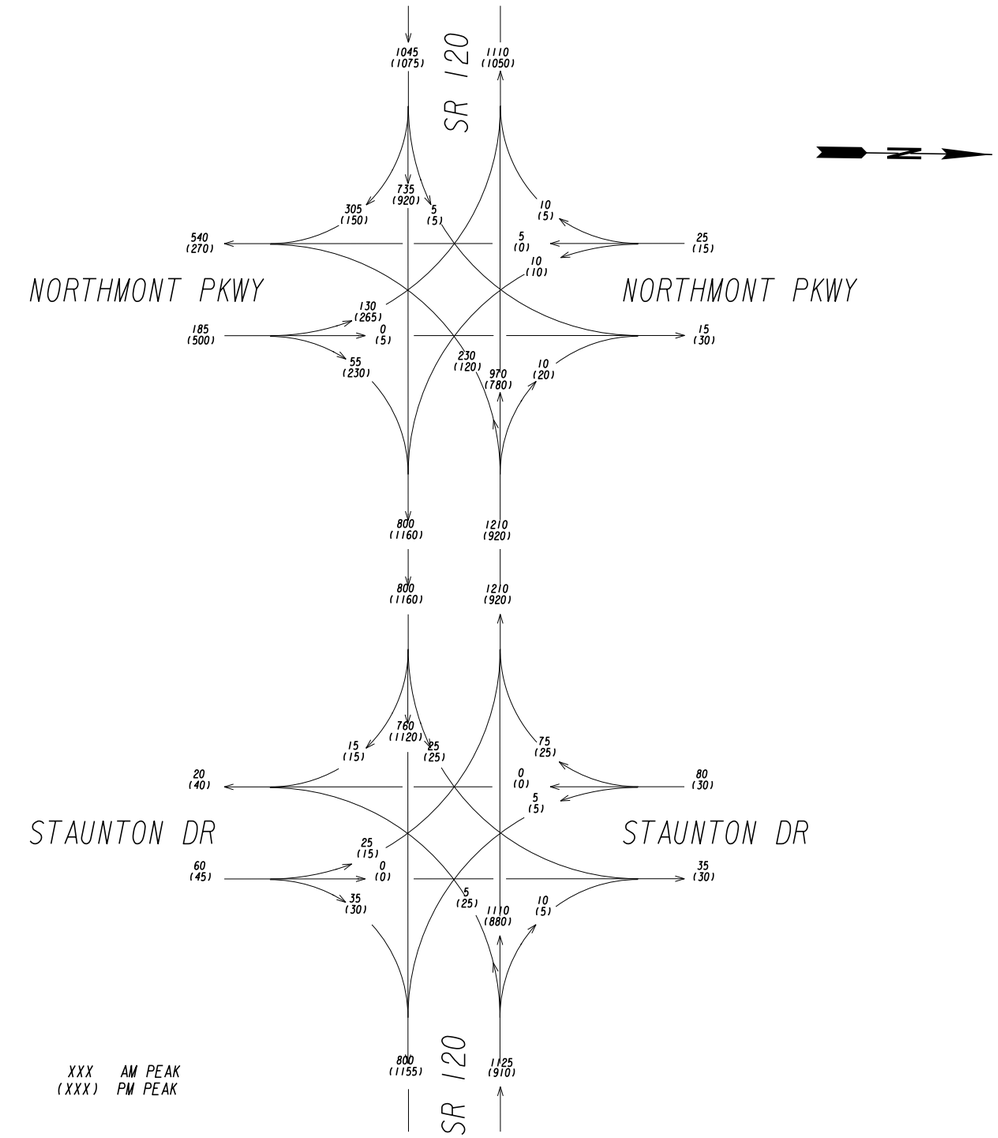


XXX ADT

Daily Trucks		
Single Unit	Combination	Total
7.0%	1.0%	8.0%

BUILD TRAFFIC IS THE SAME AS NO BUILD

2020 DESIGN HOUR



XXX AM PEAK
(XXX) PM PEAK

Peak Hour Trucks		
Single Unit	Combination	Total
8.0%	1.0%	9.0%

BUILD TRAFFIC IS THE SAME AS NO BUILD

PI 0132986
GWINNETT COUNTY
AUGUST 11, 2015
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DEPARTMENT OF TRANSPORTATION
OFFICE:

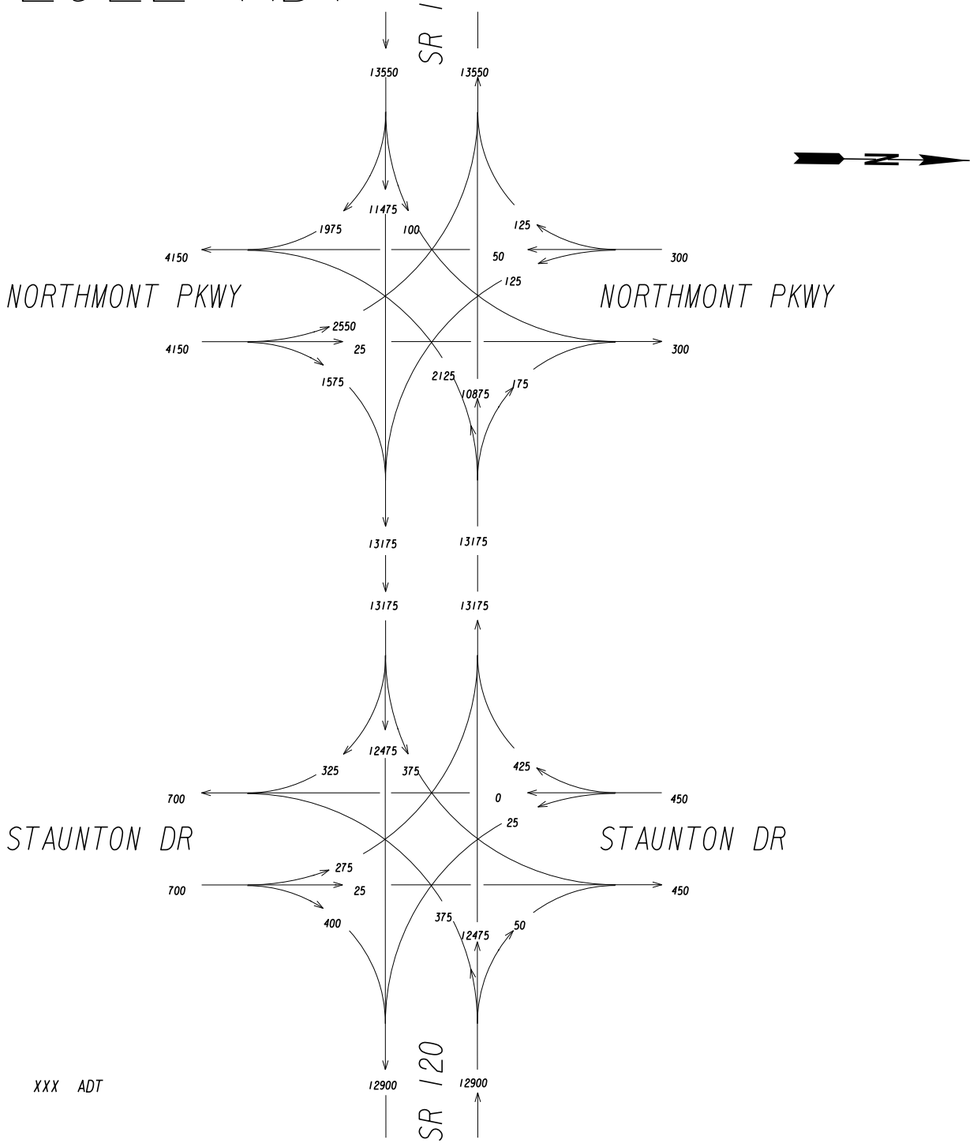
TRAFFIC DIAGRAM

SR 120 AT SINGLETON CREEK

DRAWING No. 10-002

14-AUG-2015 09:27	9:27:18 AM	132986-TRDG2	Y:\Roadways\146615\132986\DGN\132986-TRDG.dgn	STATE	PROJECT NUMBER	SHEET NO. / TOTAL SHEETS
bill.ruhsam		GDOT_11x17.pen		GA	P.I. 132986	

2022 ADT

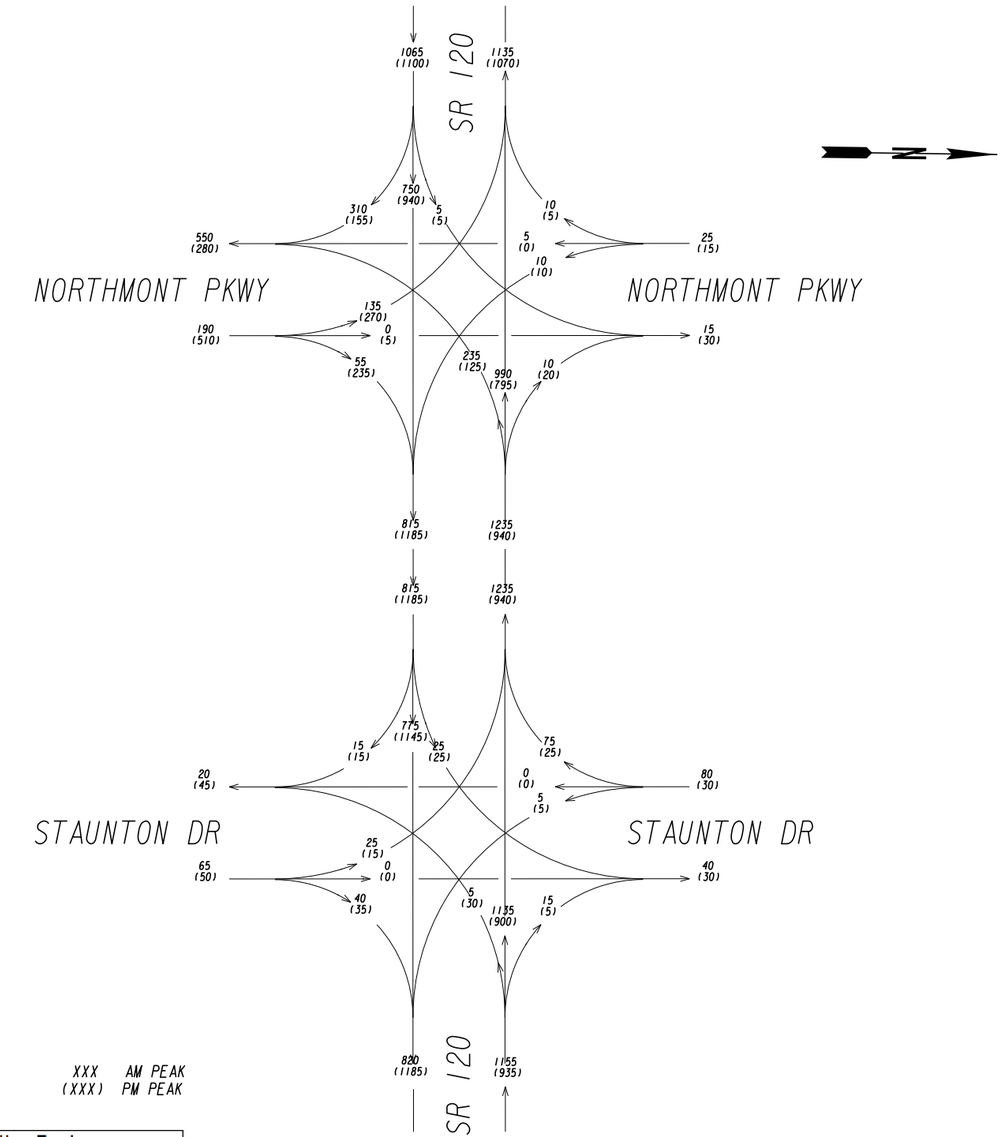


XXX ADT

Daily Trucks		
Single Unit	Combination	Total
7.0%	1.0%	8.0%

BUILD TRAFFIC IS THE SAME AS NO BUILD

2022 DESIGN HOUR



XXX AM PEAK
(XXX) PM PEAK

Peak Hour Trucks		
Single Unit	Combination	Total
8.0%	1.0%	9.0%

BUILD TRAFFIC IS THE SAME AS NO BUILD

PI 0132986
GWINNETT COUNTY
AUGUST 11, 2015
WMR/KMC

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GEORGIA
DEPARTMENT OF TRANSPORTATION

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STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE:

TRAFFIC DIAGRAM

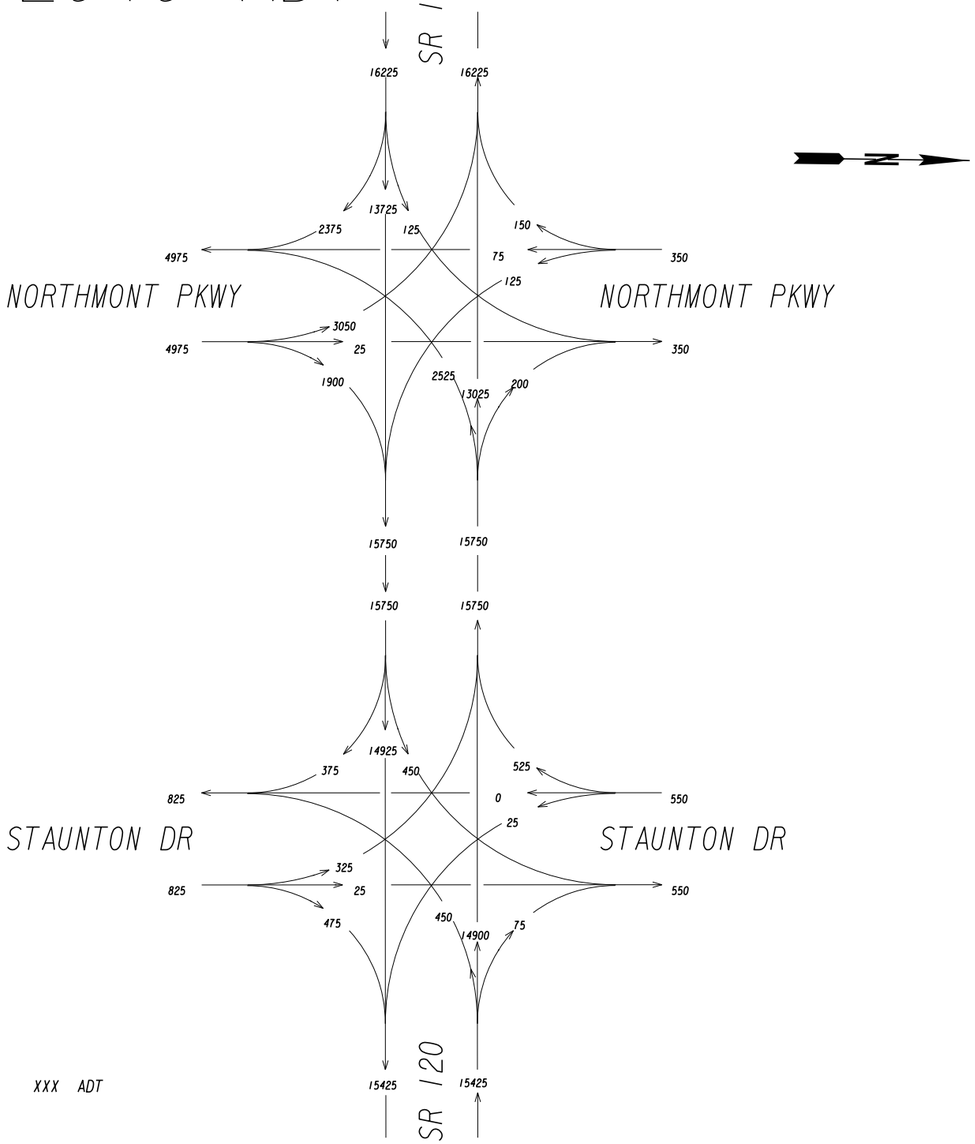
SR 120 AT SINGLETON CREEK

DRAWING No. 10-003

01/26/2015 GPLN

14-AUG-2015 09:27	9:27:26 AM	132986-TRDG3	Y:\Roadways\146615\132986\DGN\132986-TRDG.dgn	STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
bill.ruhsam		GDOT_11x17.pen		GA	P.I. 132986	4	5

2040 ADT

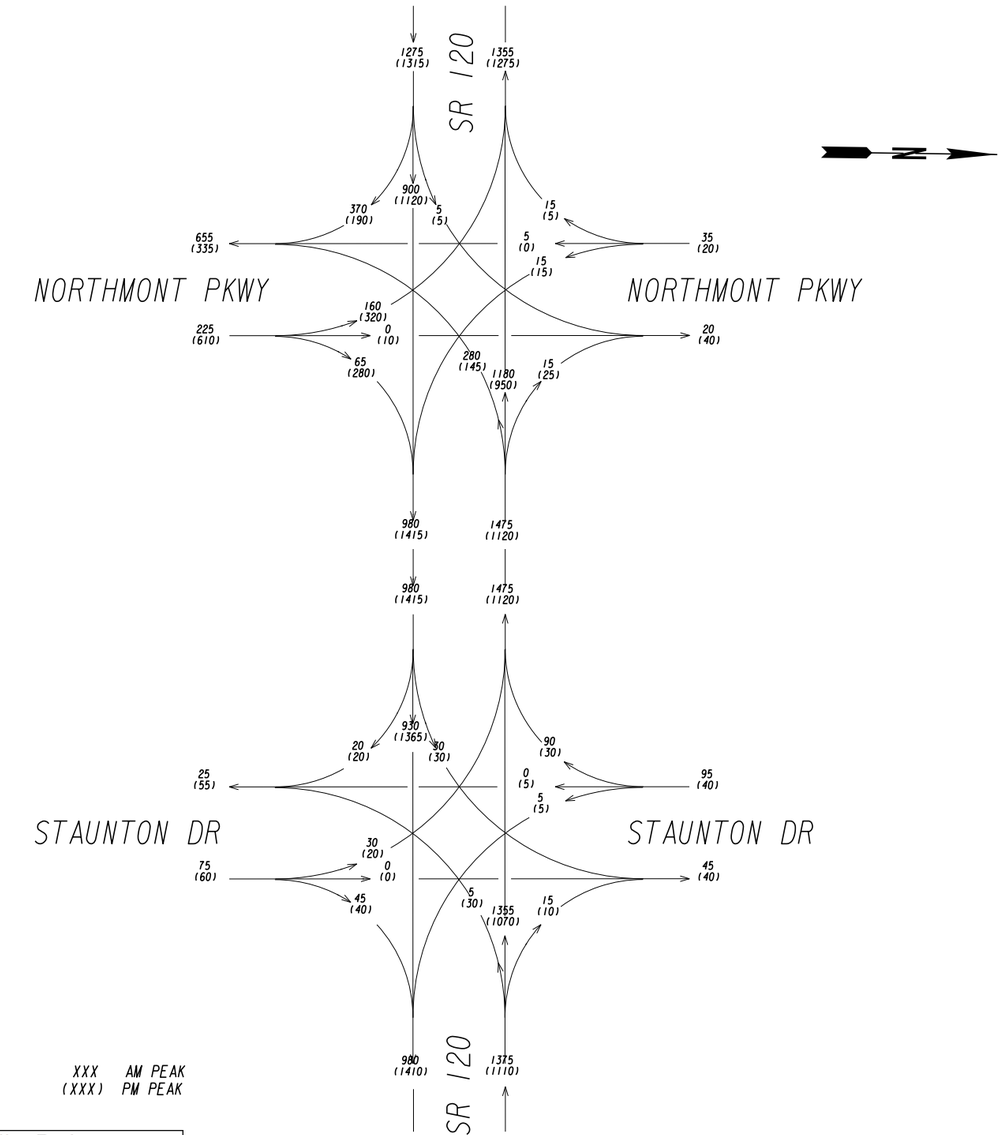


XXX ADT

Daily Trucks		
Single Unit	Combination	Total
7.0%	1.0%	8.0%

BUILD TRAFFIC IS THE SAME AS NO BUILD

2040 DESIGN HOUR



XXX AM PEAK
(XXX) PM PEAK

Peak Hour Trucks		
Single Unit	Combination	Total
8.0%	1.0%	9.0%

BUILD TRAFFIC IS THE SAME AS NO BUILD

PI 0132986
GWINNETT COUNTY
AUGUST 11, 2015
WMR/KMC

01/26/2015 GPLN

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INTERNATIONAL
3595 ENGINEERING DRIVE
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GEORGIA
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DEPARTMENT OF TRANSPORTATION
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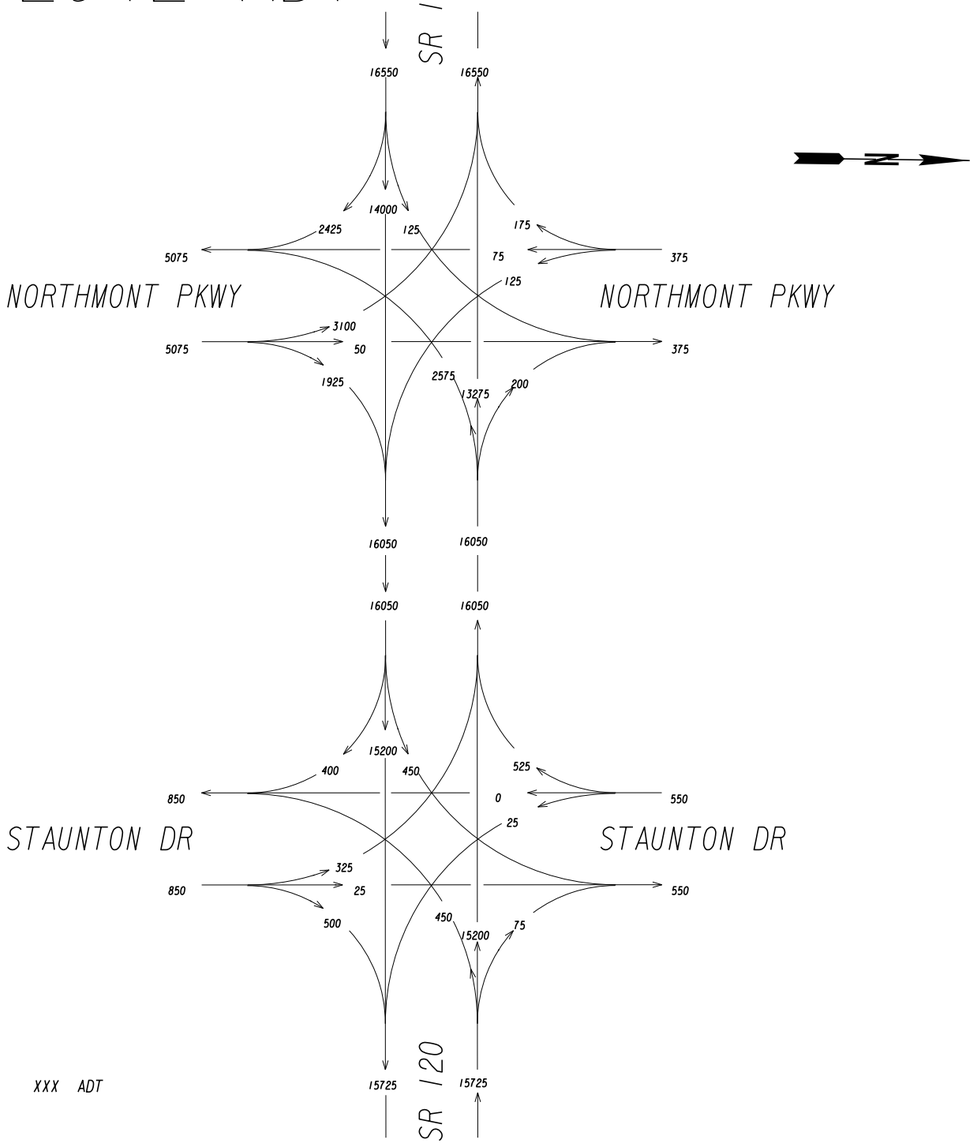
TRAFFIC DIAGRAM

SR 120 AT SINGLETON CREEK

DRAWING No.
10-004

14-AUG-2015 09:27	9:27:34 AM	132986-TRDG4	Y:\Roadways\146615\132986\DGN\132986-TRDG.dgn	STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
bill.ruhsam		GDOT_11x17.pen		GA	P.I. 132986		

2042 ADT

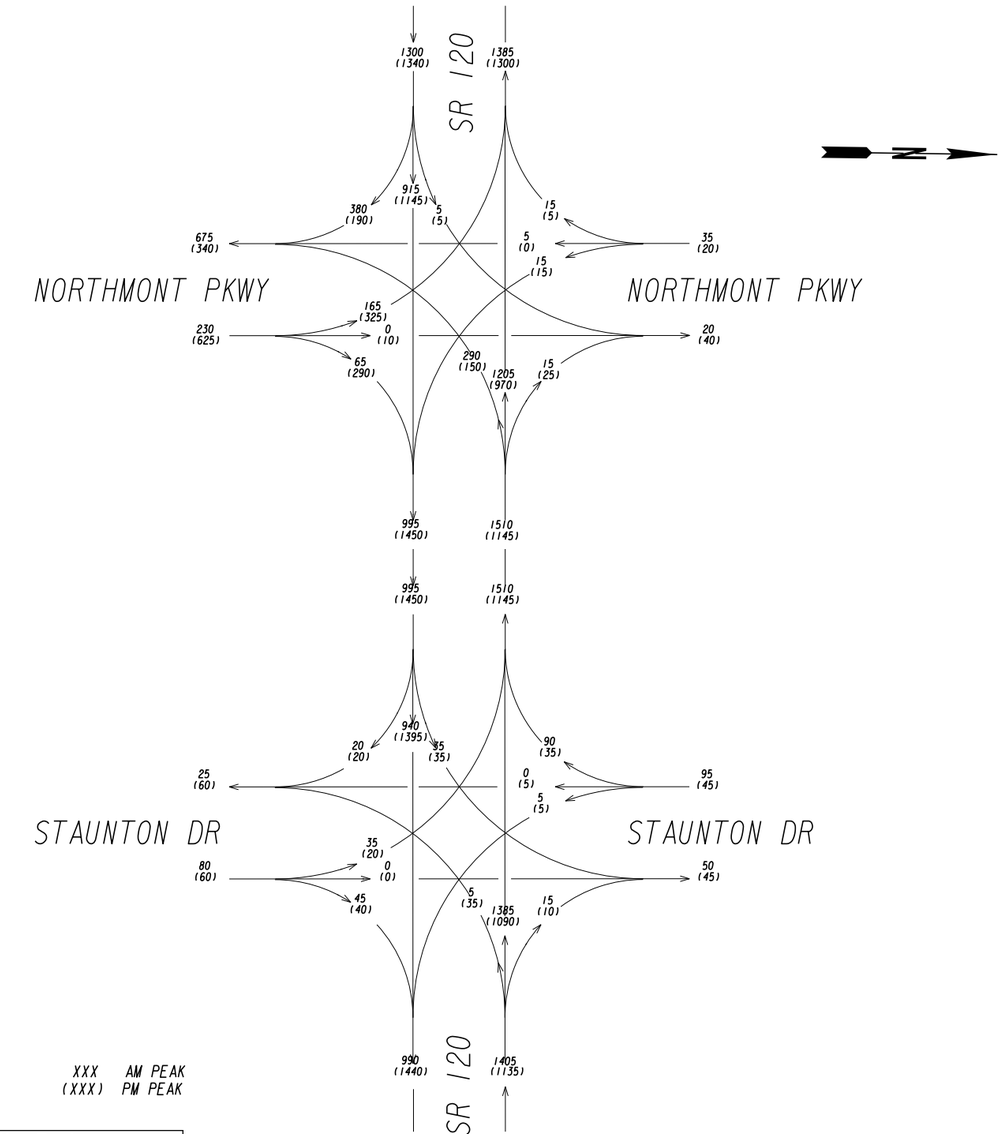


XXX ADT

Daily Trucks		
Single Unit	Combination	Total
7.0%	1.0%	8.0%

BUILD TRAFFIC IS THE SAME AS NO BUILD

2042 DESIGN HOUR



XXX AM PEAK
(XXX) PM PEAK

Peak Hour Trucks		
Single Unit	Combination	Total
8.0%	1.0%	9.0%

BUILD TRAFFIC IS THE SAME AS NO BUILD

PI 0132986
GWINNETT COUNTY
AUGUST 11, 2015
WMR/KMC

01/26/2015 GPLN

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3595 ENGINEERING DRIVE
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(770) 263-9118

GEORGIA
DEPARTMENT OF TRANSPORTATION

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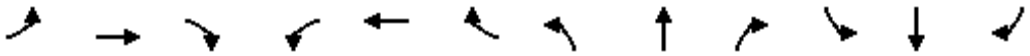
STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE:

TRAFFIC DIAGRAM

SR 120 AT SINGLETON CREEK

DRAWING No.
10-005

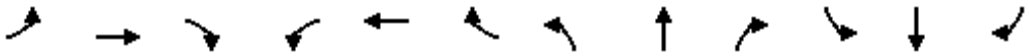
Appendix B – Synchro Reports



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	700	290	220	920	10	125	0	50	10	5	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11	12	12	12	12	12	12
Grade (%)		-4%			3%			-4%			0%	
Total Lost time (s)	6.3	6.3	6.3	5.3	6.3	6.3	6.3		6.3	6.3	6.3	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00		0.85	1.00	0.90	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00	
Satd. Flow (prot)	1633	1719	1461	1577	1660	1411	1689		1511	1770	1671	
Flt Permitted	0.24	1.00	1.00	0.17	1.00	1.00	0.75		1.00	0.76	1.00	
Satd. Flow (perm)	412	1719	1461	283	1660	1411	1328		1511	1410	1671	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	5	761	315	239	1000	11	136	0	54	11	5	11
RTOR Reduction (vph)	0	0	120	0	0	3	0	0	46	0	9	0
Lane Group Flow (vph)	5	761	195	239	1000	8	136	0	8	11	7	0
Heavy Vehicles (%)	9%	9%	9%	9%	9%	9%	9%	9%	9%	2%	2%	2%
Turn Type	Perm	NA	Perm	pm+pt	NA	Perm	Perm		Perm	Perm	NA	
Protected Phases		6		5	2			8			4	
Permitted Phases	6		6	2		2	8		8	4		
Actuated Green, G (s)	47.6	47.6	47.6	63.2	63.2	63.2	12.7		12.7	12.7	12.7	
Effective Green, g (s)	47.6	47.6	47.6	63.2	63.2	63.2	12.7		12.7	12.7	12.7	
Actuated g/C Ratio	0.54	0.54	0.54	0.71	0.71	0.71	0.14		0.14	0.14	0.14	
Clearance Time (s)	6.3	6.3	6.3	5.3	6.3	6.3	6.3		6.3	6.3	6.3	
Vehicle Extension (s)	3.0	3.0	3.0	0.2	3.0	3.0	0.2		0.2	0.2	0.2	
Lane Grp Cap (vph)	221	924	785	352	1185	1007	190		216	202	239	
v/s Ratio Prot		0.44		0.08	c0.60						0.00	
v/s Ratio Perm	0.01		0.13	0.40		0.01	c0.10		0.01	0.01		
v/c Ratio	0.02	0.82	0.25	0.68	0.84	0.01	0.72		0.04	0.05	0.03	
Uniform Delay, d1	9.6	17.0	10.9	11.9	9.1	3.6	36.2		32.6	32.7	32.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	
Incremental Delay, d2	0.0	6.0	0.2	4.1	5.7	0.0	10.2		0.0	0.0	0.0	
Delay (s)	9.6	23.0	11.1	16.0	14.8	3.6	46.3		32.7	32.8	32.6	
Level of Service	A	C	B	B	B	A	D		C	C	C	
Approach Delay (s)		19.5			14.9			42.5			32.7	
Approach LOS		B			B			D			C	

Intersection Summary			
HCM 2000 Control Delay	19.1	HCM 2000 Level of Service	B
HCM 2000 Volume to Capacity ratio	0.88		
Actuated Cycle Length (s)	88.5	Sum of lost time (s)	17.9
Intersection Capacity Utilization	92.8%	ICU Level of Service	F
Analysis Period (min)	15		

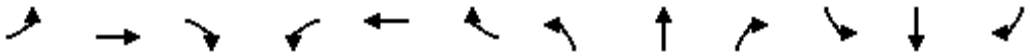
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	25	720	15	5	1055	10	25	0	35	5	0	70
Sign Control		Free			Free			Stop			Stop	
Grade		3%			-4%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	783	16	5	1147	11	27	0	38	5	0	76
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		1058										
pX, platoon unblocked				0.62			0.62	0.62	0.62	0.62	0.62	
vC, conflicting volume	1158			799			2071	2005	783	2033	2011	1147
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1158			369			2421	2315	343	2359	2324	1147
tC, single (s)	4.2			4.2			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.3			2.3			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	95			99			0	100	91	59	100	69
cM capacity (veh/h)	579			714			9	22	434	13	22	242

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	27	783	16	5	1147	11	65	82
Volume Left	27	0	0	5	0	0	27	5
Volume Right	0	0	16	0	0	11	38	76
cSH	579	1700	1700	714	1700	1700	21	113
Volume to Capacity	0.05	0.46	0.01	0.01	0.67	0.01	3.08	0.72
Queue Length 95th (ft)	4	0	0	1	0	0	Err	97
Control Delay (s)	11.5	0.0	0.0	10.1	0.0	0.0	Err	93.4
Lane LOS	B			B			F	F
Approach Delay (s)	0.4			0.0			Err	93.4
Approach LOS							F	F

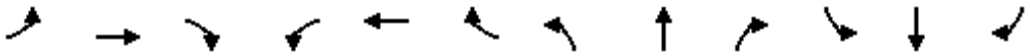
Intersection Summary				
Average Delay	309.0			
Intersection Capacity Utilization	72.4%	ICU Level of Service		C
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	875	145	115	740	20	250	5	220	10	0	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11	12	12	12	12	12	12
Grade (%)		-4%			3%			-4%			0%	
Total Lost time (s)	6.3	6.3	6.3	5.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1633	1719	1461	1577	1660	1411	1689	1778	1511	1770	1583	
Flt Permitted	0.32	1.00	1.00	0.07	1.00	1.00	0.75	1.00	1.00	0.75	1.00	
Satd. Flow (perm)	545	1719	1461	119	1660	1411	1341	1778	1511	1405	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	5	951	158	125	804	22	272	5	239	11	0	5
RTOR Reduction (vph)	0	0	45	0	0	7	0	0	191	0	4	0
Lane Group Flow (vph)	5	951	113	125	804	15	272	5	48	11	1	0
Heavy Vehicles (%)	9%	9%	9%	9%	9%	9%	9%	9%	9%	2%	2%	2%
Turn Type	Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	
Protected Phases		6		5	2			8			4	
Permitted Phases	6		6	2		2	8		8	4		
Actuated Green, G (s)	69.1	69.1	69.1	84.2	84.2	84.2	24.5	24.5	24.5	24.5	24.5	
Effective Green, g (s)	69.1	69.1	69.1	84.2	84.2	84.2	24.5	24.5	24.5	24.5	24.5	
Actuated g/C Ratio	0.57	0.57	0.57	0.69	0.69	0.69	0.20	0.20	0.20	0.20	0.20	
Clearance Time (s)	6.3	6.3	6.3	5.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	
Vehicle Extension (s)	3.0	3.0	3.0	0.2	3.0	3.0	0.2	0.2	0.2	0.2	0.2	
Lane Grp Cap (vph)	310	979	832	200	1152	979	270	359	305	283	319	
v/s Ratio Prot		c0.55		0.05	c0.48			0.00			0.00	
v/s Ratio Perm	0.01		0.08	0.38		0.01	c0.20		0.03	0.01		
v/c Ratio	0.02	0.97	0.14	0.62	0.70	0.02	1.01	0.01	0.16	0.04	0.00	
Uniform Delay, d1	11.3	25.1	12.2	25.2	11.0	5.7	48.4	38.7	39.9	38.9	38.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.0	22.0	0.1	4.3	1.9	0.0	56.7	0.0	0.1	0.0	0.0	
Delay (s)	11.4	47.1	12.3	29.5	12.9	5.7	105.1	38.7	40.0	39.0	38.7	
Level of Service	B	D	B	C	B	A	F	D	D	D	D	
Approach Delay (s)		42.0			14.9			74.3			38.9	
Approach LOS		D			B			E			D	

Intersection Summary			
HCM 2000 Control Delay	38.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	121.3	Sum of lost time (s)	17.9
Intersection Capacity Utilization	90.2%	ICU Level of Service	E
Analysis Period (min)	15		

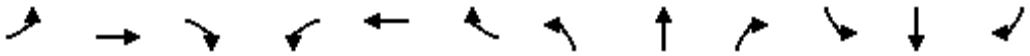
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	25	1065	15	25	835	5	15	0	30	5	0	25
Sign Control		Free			Free			Stop			Stop	
Grade		3%			-4%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	1158	16	27	908	5	16	0	33	5	0	27
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		1058										
pX, platoon unblocked				0.46			0.46	0.46	0.46	0.46	0.46	
vC, conflicting volume	913			1174			2201	2179	1158	2207	2190	908
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	913			792			3023	2975	756	3034	2999	908
tC, single (s)	4.2			4.2			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.3			2.3			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	96			93			0	100	83	0	100	92
cM capacity (veh/h)	718			368			3	6	188	3	6	334

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	27	1158	16	27	908	5	49	33
Volume Left	27	0	0	27	0	0	16	5
Volume Right	0	0	16	0	0	5	33	27
cSH	718	1700	1700	368	1700	1700	9	16
Volume to Capacity	0.04	0.68	0.01	0.07	0.53	0.00	5.38	2.05
Queue Length 95th (ft)	3	0	0	6	0	0	Err	117
Control Delay (s)	10.2	0.0	0.0	15.6	0.0	0.0	Err	981.2
Lane LOS	B			C			F	F
Approach Delay (s)	0.2			0.4			Err	981.2
Approach LOS							F	F

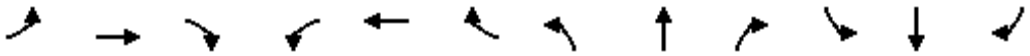
Intersection Summary				
Average Delay	234.7			
Intersection Capacity Utilization	67.6%	ICU Level of Service	C	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	735	305	230	970	10	130	0	55	10	5	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11	12	12	12	12	12	12
Grade (%)		-4%			3%			-4%			0%	
Total Lost time (s)	6.3	6.3	6.3	5.3	6.3	6.3	6.3		6.3	6.3	6.3	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00		0.85	1.00	0.90	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00	
Satd. Flow (prot)	1633	1719	1461	1577	1660	1411	1689		1511	1770	1671	
Flt Permitted	0.21	1.00	1.00	0.17	1.00	1.00	0.75		1.00	0.76	1.00	
Satd. Flow (perm)	357	1719	1461	282	1660	1411	1328		1511	1410	1671	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	5	799	332	250	1054	11	141	0	60	11	5	11
RTOR Reduction (vph)	0	0	112	0	0	3	0	0	51	0	9	0
Lane Group Flow (vph)	5	799	220	250	1054	8	141	0	9	11	7	0
Heavy Vehicles (%)	9%	9%	9%	9%	9%	9%	9%	9%	9%	2%	2%	2%
Turn Type	Perm	NA	Perm	pm+pt	NA	Perm	Perm		Perm	Perm	NA	
Protected Phases		6		5	2			8			4	
Permitted Phases	6		6	2		2	8		8	4		
Actuated Green, G (s)	57.3	57.3	57.3	73.4	73.4	73.4	14.4		14.4	14.4	14.4	
Effective Green, g (s)	57.3	57.3	57.3	73.4	73.4	73.4	14.4		14.4	14.4	14.4	
Actuated g/C Ratio	0.57	0.57	0.57	0.73	0.73	0.73	0.14		0.14	0.14	0.14	
Clearance Time (s)	6.3	6.3	6.3	5.3	6.3	6.3	6.3		6.3	6.3	6.3	
Vehicle Extension (s)	3.0	3.0	3.0	0.2	3.0	3.0	0.2		0.2	0.2	0.2	
Lane Grp Cap (vph)	203	981	833	345	1213	1031	190		216	202	239	
v/s Ratio Prot		0.46		0.08	c0.64						0.00	
v/s Ratio Perm	0.01		0.15	0.45		0.01	c0.11		0.01	0.01		
v/c Ratio	0.02	0.81	0.26	0.72	0.87	0.01	0.74		0.04	0.05	0.03	
Uniform Delay, d1	9.4	17.3	10.9	13.8	10.0	3.7	41.2		37.0	37.1	37.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	
Incremental Delay, d2	0.0	5.3	0.2	6.3	6.8	0.0	12.8		0.0	0.0	0.0	
Delay (s)	9.4	22.6	11.1	20.1	16.8	3.7	54.0		37.1	37.2	37.0	
Level of Service	A	C	B	C	B	A	D		D	D	D	
Approach Delay (s)		19.1			17.3			48.9			37.1	
Approach LOS		B			B			D			D	

Intersection Summary			
HCM 2000 Control Delay	20.7	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.90		
Actuated Cycle Length (s)	100.4	Sum of lost time (s)	17.9
Intersection Capacity Utilization	95.7%	ICU Level of Service	F
Analysis Period (min)	15		

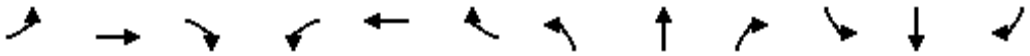
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	25	760	15	5	1110	10	25	0	35	5	0	75
Sign Control		Free			Free			Stop			Stop	
Grade		3%			-4%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	826	16	5	1207	11	27	0	38	5	0	82
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		1058										
pX, platoon unblocked				0.61			0.61	0.61	0.61	0.61	0.61	
vC, conflicting volume	1217			842			2179	2109	826	2136	2114	1207
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1217			422			2613	2497	396	2542	2506	1207
tC, single (s)	4.2			4.2			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.3			2.3			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	95			99			0	100	90	43	100	64
cM capacity (veh/h)	549			671			6	17	399	10	16	224

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	27	826	16	5	1207	11	65	87
Volume Left	27	0	0	5	0	0	27	5
Volume Right	0	0	16	0	0	11	38	82
cSH	549	1700	1700	671	1700	1700	14	93
Volume to Capacity	0.05	0.49	0.01	0.01	0.71	0.01	4.64	0.93
Queue Length 95th (ft)	4	0	0	1	0	0	Err	133
Control Delay (s)	11.9	0.0	0.0	10.4	0.0	0.0	Err	156.0
Lane LOS	B			B			F	F
Approach Delay (s)	0.4			0.0			Err	156.0
Approach LOS							F	F

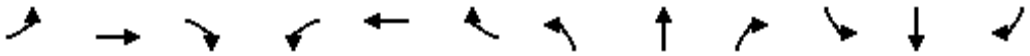
Intersection Summary				
Average Delay	296.7			
Intersection Capacity Utilization	75.3%	ICU Level of Service	D	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	920	150	120	780	20	265	5	230	10	0	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11	12	12	12	12	12	12
Grade (%)		-4%			3%			-4%			0%	
Total Lost time (s)	6.3	6.3	6.3	5.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1633	1719	1461	1577	1660	1411	1689	1778	1511	1770	1583	
Flt Permitted	0.30	1.00	1.00	0.07	1.00	1.00	0.75	1.00	1.00	0.75	1.00	
Satd. Flow (perm)	514	1719	1461	111	1660	1411	1341	1778	1511	1405	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	5	1000	163	130	848	22	288	5	250	11	0	5
RTOR Reduction (vph)	0	0	41	0	0	6	0	0	203	0	4	0
Lane Group Flow (vph)	5	1000	122	130	848	16	288	5	47	11	1	0
Heavy Vehicles (%)	9%	9%	9%	9%	9%	9%	9%	9%	9%	2%	2%	2%
Turn Type	Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	
Protected Phases		6		5	2			8			4	
Permitted Phases	6		6	2		2	8		8	4		
Actuated Green, G (s)	77.9	77.9	77.9	93.6	93.6	93.6	24.3	24.3	24.3	24.3	24.3	
Effective Green, g (s)	77.9	77.9	77.9	93.6	93.6	93.6	24.3	24.3	24.3	24.3	24.3	
Actuated g/C Ratio	0.60	0.60	0.60	0.72	0.72	0.72	0.19	0.19	0.19	0.19	0.19	
Clearance Time (s)	6.3	6.3	6.3	5.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	
Vehicle Extension (s)	3.0	3.0	3.0	0.2	3.0	3.0	0.2	0.2	0.2	0.2	0.2	
Lane Grp Cap (vph)	306	1026	872	196	1190	1012	249	331	281	261	294	
v/s Ratio Prot		c0.58		0.05	c0.51			0.00			0.00	
v/s Ratio Perm	0.01		0.08	0.42		0.01	c0.21		0.03	0.01		
v/c Ratio	0.02	0.97	0.14	0.66	0.71	0.02	1.16	0.02	0.17	0.04	0.00	
Uniform Delay, d1	10.7	25.3	11.6	31.0	10.7	5.3	53.1	43.3	44.6	43.6	43.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.0	22.0	0.1	6.4	2.0	0.0	106.0	0.0	0.1	0.0	0.0	
Delay (s)	10.7	47.3	11.6	37.4	12.7	5.3	159.1	43.3	44.7	43.6	43.2	
Level of Service	B	D	B	D	B	A	F	D	D	D	D	
Approach Delay (s)		42.2			15.8			105.3			43.5	
Approach LOS		D			B			F			D	

Intersection Summary			
HCM 2000 Control Delay	45.1	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.01		
Actuated Cycle Length (s)	130.5	Sum of lost time (s)	17.9
Intersection Capacity Utilization	93.2%	ICU Level of Service	F
Analysis Period (min)	15		

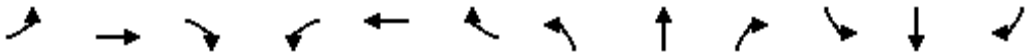
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	25	1120	15	25	880	5	15	0	30	5	0	25
Sign Control		Free			Free			Stop			Stop	
Grade		3%			-4%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	1217	16	27	957	5	16	0	33	5	0	27
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		1058										
pX, platoon unblocked				0.43			0.43	0.43	0.43	0.43	0.43	
vC, conflicting volume	962			1234			2310	2288	1217	2315	2299	957
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	962			882			3381	3330	844	3393	3355	957
tC, single (s)	4.2			4.2			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.3			2.3			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	96			91			0	100	79	0	100	91
cM capacity (veh/h)	688			318			2	3	156	1	3	313

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	27	1217	16	27	957	5	49	33
Volume Left	27	0	0	27	0	0	16	5
Volume Right	0	0	16	0	0	5	33	27
cSH	688	1700	1700	318	1700	1700	5	8
Volume to Capacity	0.04	0.72	0.01	0.09	0.56	0.00	10.65	4.19
Queue Length 95th (ft)	3	0	0	7	0	0	Err	Err
Control Delay (s)	10.4	0.0	0.0	17.4	0.0	0.0	Err	Err
Lane LOS	B			C			F	F
Approach Delay (s)	0.2			0.5			Err	Err
Approach LOS							F	F

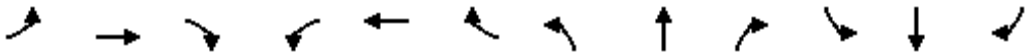
Intersection Summary				
Average Delay	349.9			
Intersection Capacity Utilization	70.5%	ICU Level of Service	C	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	900	370	280	1180	15	160	0	65	15	5	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11	12	12	12	12	12	12
Grade (%)		-4%			3%			-4%			0%	
Total Lost time (s)	6.3	6.3	6.3	5.3	6.3	6.3	6.3		6.3	6.3	6.3	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00		0.85	1.00	0.89	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00	
Satd. Flow (prot)	1633	1719	1461	1577	1660	1411	1689		1511	1770	1650	
Flt Permitted	0.09	1.00	1.00	0.11	1.00	1.00	0.74		1.00	0.76	1.00	
Satd. Flow (perm)	156	1719	1461	188	1660	1411	1322		1511	1410	1650	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	5	978	402	304	1283	16	174	0	71	16	5	16
RTOR Reduction (vph)	0	0	94	0	0	4	0	0	61	0	14	0
Lane Group Flow (vph)	5	978	308	304	1283	12	174	0	10	16	7	0
Heavy Vehicles (%)	9%	9%	9%	9%	9%	9%	9%	9%	9%	2%	2%	2%
Turn Type	Perm	NA	Perm	pm+pt	NA	Perm	Perm		Perm	Perm	NA	
Protected Phases		6		5	2			8			4	
Permitted Phases	6		6	2		2	8		8	4		
Actuated Green, G (s)	93.8	93.8	93.8	113.8	113.8	113.8	20.9		20.9	20.9	20.9	
Effective Green, g (s)	93.8	93.8	93.8	113.8	113.8	113.8	20.9		20.9	20.9	20.9	
Actuated g/C Ratio	0.64	0.64	0.64	0.77	0.77	0.77	0.14		0.14	0.14	0.14	
Clearance Time (s)	6.3	6.3	6.3	5.3	6.3	6.3	6.3		6.3	6.3	6.3	
Vehicle Extension (s)	3.0	3.0	3.0	0.2	3.0	3.0	0.2		0.2	0.2	0.2	
Lane Grp Cap (vph)	99	1094	930	283	1282	1090	187		214	200	234	
v/s Ratio Prot		0.57		0.11	c0.77						0.00	
v/s Ratio Perm	0.03		0.21	c0.72		0.01	c0.13		0.01	0.01		
v/c Ratio	0.05	0.89	0.33	1.07	1.00	0.01	0.93		0.05	0.08	0.03	
Uniform Delay, d1	10.0	22.6	12.3	39.9	16.8	3.8	62.5		54.6	54.9	54.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	
Incremental Delay, d2	0.2	9.5	0.2	74.6	25.3	0.0	45.7		0.0	0.1	0.0	
Delay (s)	10.3	32.1	12.5	114.5	42.1	3.8	108.2		54.6	54.9	54.5	
Level of Service	B	C	B	F	D	A	F		D	D	D	
Approach Delay (s)		26.3			55.4			92.7			54.7	
Approach LOS		C			E			F			D	

Intersection Summary			
HCM 2000 Control Delay	45.9	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	147.3	Sum of lost time (s)	17.9
Intersection Capacity Utilization	108.4%	ICU Level of Service	G
Analysis Period (min)	15		

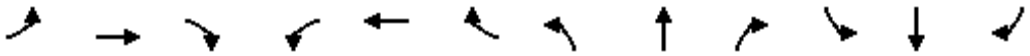
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	30	930	20	5	1365	15	30	0	45	5	0	90
Sign Control		Free			Free			Stop			Stop	
Grade		3%			-4%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	1011	22	5	1484	16	33	0	49	5	0	98
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		1058										
pX, platoon unblocked				0.48			0.48	0.48	0.48	0.48	0.48	
vC, conflicting volume	1500			1033			2668	2587	1011	2620	2592	1484
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1500			517			3959	3787	471	3856	3799	1484
tC, single (s)	4.2			4.2			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.3			2.3			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	92			99			0	100	83	0	100	36
cM capacity (veh/h)	427			482			0	2	282	1	2	153

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	33	1011	22	5	1484	16	82	103
Volume Left	33	0	0	5	0	0	33	5
Volume Right	0	0	22	0	0	16	49	98
cSH	427	1700	1700	482	1700	1700	1	12
Volume to Capacity	0.08	0.59	0.01	0.01	0.87	0.01	126.34	8.34
Queue Length 95th (ft)	6	0	0	1	0	0	Err	Err
Control Delay (s)	14.1	0.0	0.0	12.6	0.0	0.0	Err	Err
Lane LOS	B			B			F	F
Approach Delay (s)	0.4			0.0			Err	Err
Approach LOS							F	F

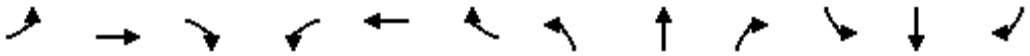
Intersection Summary				
Average Delay	670.7			
Intersection Capacity Utilization	89.6%	ICU Level of Service	E	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	1120	190	145	950	25	320	10	280	15	0	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11	12	12	12	12	12	12
Grade (%)		-4%			3%			-4%			0%	
Total Lost time (s)	6.3	6.3	6.3	5.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1633	1719	1461	1577	1660	1411	1689	1778	1511	1770	1583	
Flt Permitted	0.22	1.00	1.00	0.04	1.00	1.00	0.75	1.00	1.00	0.75	1.00	
Satd. Flow (perm)	373	1719	1461	67	1660	1411	1341	1778	1511	1398	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	5	1217	207	158	1033	27	348	11	304	16	0	5
RTOR Reduction (vph)	0	0	40	0	0	6	0	0	183	0	4	0
Lane Group Flow (vph)	5	1217	167	158	1033	21	348	11	121	16	1	0
Heavy Vehicles (%)	9%	9%	9%	9%	9%	9%	9%	9%	9%	2%	2%	2%
Turn Type	Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA	Perm	Perm	NA	
Protected Phases		6		5	2			8			4	
Permitted Phases	6		6	2		2	8		8	4		
Actuated Green, G (s)	93.8	93.8	93.8	112.4	112.4	112.4	23.7	23.7	23.7	23.7	23.7	
Effective Green, g (s)	93.8	93.8	93.8	112.4	112.4	112.4	23.7	23.7	23.7	23.7	23.7	
Actuated g/C Ratio	0.63	0.63	0.63	0.76	0.76	0.76	0.16	0.16	0.16	0.16	0.16	
Clearance Time (s)	6.3	6.3	6.3	5.3	6.3	6.3	6.3	6.3	6.3	6.3	6.3	
Vehicle Extension (s)	3.0	3.0	3.0	0.2	3.0	3.0	0.2	0.2	0.2	0.2	0.2	
Lane Grp Cap (vph)	235	1084	921	185	1254	1066	213	283	240	222	252	
v/s Ratio Prot		c0.71		0.08	c0.62			0.01			0.00	
v/s Ratio Perm	0.01		0.11	0.57		0.01	c0.26		0.08	0.01		
v/c Ratio	0.02	1.12	0.18	0.85	0.82	0.02	1.63	0.04	0.50	0.07	0.00	
Uniform Delay, d1	10.3	27.4	11.4	54.1	11.7	4.5	62.5	52.9	57.1	53.1	52.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.0	67.6	0.1	28.9	4.5	0.0	305.5	0.0	0.6	0.1	0.0	
Delay (s)	10.3	95.1	11.5	83.0	16.3	4.5	368.0	52.9	57.7	53.2	52.6	
Level of Service	B	F	B	F	B	A	F	D	E	D	D	
Approach Delay (s)		82.7			24.7			220.5			53.0	
Approach LOS		F			C			F			D	

Intersection Summary			
HCM 2000 Control Delay	88.7	HCM 2000 Level of Service	F
HCM 2000 Volume to Capacity ratio	1.20		
Actuated Cycle Length (s)	148.7	Sum of lost time (s)	17.9
Intersection Capacity Utilization	106.3%	ICU Level of Service	G
Analysis Period (min)	15		

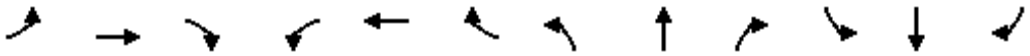
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	30	1365	20	30	1070	10	20	0	40	5	5	30
Sign Control		Free			Free			Stop			Stop	
Grade		3%			-4%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	1484	22	33	1163	11	22	0	43	5	5	33
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		1058										
pX, platoon unblocked				0.38			0.38	0.38	0.38	0.38	0.38	
vC, conflicting volume	1174			1505			2812	2788	1484	2821	2799	1163
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1174			1514			4950	4886	1457	4972	4914	1163
tC, single (s)	4.2			4.2			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.3			2.3			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	94			80			0	100	28	0	0	86
cM capacity (veh/h)	571			160			0	0	61	0	0	237

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	33	1484	22	33	1163	11	65	43
Volume Left	33	0	0	33	0	0	22	5
Volume Right	0	0	22	0	0	11	43	33
cSH	571	1700	1700	160	1700	1700	0	0
Volume to Capacity	0.06	0.87	0.01	0.20	0.68	0.01	Err	262.15
Queue Length 95th (ft)	5	0	0	18	0	0	Err	Err
Control Delay (s)	11.7	0.0	0.0	33.1	0.0	0.0	Err	Err
Lane LOS	B			D			F	F
Approach Delay (s)	0.2			0.9			Err	Err
Approach LOS							F	F

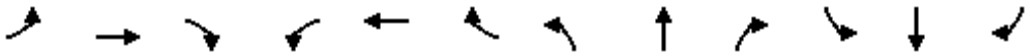
Intersection Summary				
Average Delay	Err			
Intersection Capacity Utilization	86.0%	ICU Level of Service	E	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	735	305	230	970	10	130	0	55	10	5	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11	12	12	12	12	12	12
Grade (%)		-4%			3%			-4%			0%	
Total Lost time (s)	6.3	6.3	6.3	5.3	6.3	6.3	4.0		6.3	6.3	6.3	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00		0.85	1.00	0.90	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00	
Satd. Flow (prot)	1633	1719	1461	1577	1660	1411	1689		1511	1770	1671	
Flt Permitted	0.19	1.00	1.00	0.16	1.00	1.00	0.63		1.00	1.00	1.00	
Satd. Flow (perm)	333	1719	1461	267	1660	1411	1129		1511	1863	1671	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	5	799	332	250	1054	11	141	0	60	11	5	11
RTOR Reduction (vph)	0	0	147	0	0	3	0	0	51	0	11	0
Lane Group Flow (vph)	5	799	185	250	1054	8	141	0	9	11	5	0
Heavy Vehicles (%)	9%	9%	9%	9%	9%	9%	9%	9%	9%	2%	2%	2%
Turn Type	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt		Perm	Perm	NA	
Protected Phases		6		5	2		3	8			4	
Permitted Phases	6		6	2		2	8		8	4		
Actuated Green, G (s)	49.5	49.5	49.5	63.4	63.4	63.4	13.0		13.0	2.3	2.3	
Effective Green, g (s)	49.5	49.5	49.5	63.4	63.4	63.4	13.0		13.0	2.3	2.3	
Actuated g/C Ratio	0.56	0.56	0.56	0.71	0.71	0.71	0.15		0.15	0.03	0.03	
Clearance Time (s)	6.3	6.3	6.3	5.3	6.3	6.3	4.0		6.3	6.3	6.3	
Vehicle Extension (s)	3.0	3.0	3.0	0.2	3.0	3.0	3.0		0.2	0.2	0.2	
Lane Grp Cap (vph)	185	956	812	316	1182	1005	207		220	48	43	
v/s Ratio Prot		0.46		0.08	c0.64		c0.05				0.00	
v/s Ratio Perm	0.02		0.13	0.49		0.01	c0.05		0.01	0.01		
v/c Ratio	0.03	0.84	0.23	0.79	0.89	0.01	0.68		0.04	0.23	0.12	
Uniform Delay, d1	8.9	16.4	10.0	13.3	10.1	3.7	35.5		32.6	42.5	42.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	
Incremental Delay, d2	0.1	6.4	0.1	11.9	8.8	0.0	8.9		0.0	0.9	0.5	
Delay (s)	9.0	22.8	10.2	25.2	18.9	3.7	44.4		32.7	43.4	42.8	
Level of Service	A	C	B	C	B	A	D		C	D	D	
Approach Delay (s)		19.0			19.9			40.9			43.1	
Approach LOS		B			B			D			D	

Intersection Summary			
HCM 2000 Control Delay	21.4	HCM 2000 Level of Service	C
HCM 2000 Volume to Capacity ratio	0.97		
Actuated Cycle Length (s)	89.0	Sum of lost time (s)	21.9
Intersection Capacity Utilization	95.7%	ICU Level of Service	F
Analysis Period (min)	15		

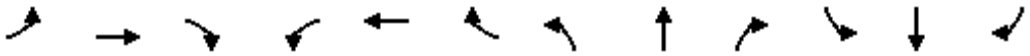
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	25	760	15	5	1110	10	25	0	35	5	0	75
Sign Control		Free			Free			Stop			Stop	
Grade		3%			-4%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	826	16	5	1207	11	27	0	38	5	0	82
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		1058										
pX, platoon unblocked				0.60			0.60	0.60	0.60	0.60	0.60	
vC, conflicting volume	1217			842			2179	2109	826	2136	2114	1207
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1217			396			2641	2522	368	2568	2531	1207
tC, single (s)	4.2			4.2			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.3			2.3			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	95			99			0	100	91	39	100	64
cM capacity (veh/h)	549			670			6	16	403	9	15	224

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	27	826	16	5	1207	11	65	87
Volume Left	27	0	0	5	0	0	27	5
Volume Right	0	0	16	0	0	11	38	82
cSH	549	1700	1700	670	1700	1700	13	90
Volume to Capacity	0.05	0.49	0.01	0.01	0.71	0.01	4.97	0.97
Queue Length 95th (ft)	4	0	0	1	0	0	Err	139
Control Delay (s)	11.9	0.0	0.0	10.4	0.0	0.0	Err	170.9
Lane LOS	B			B			F	F
Approach Delay (s)	0.4			0.0			Err	170.9
Approach LOS							F	F

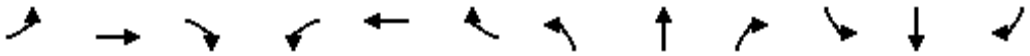
Intersection Summary				
Average Delay	297.3			
Intersection Capacity Utilization	75.3%	ICU Level of Service	D	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	920	150	120	780	20	265	5	230	10	0	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11	12	12	12	12	12	12
Grade (%)		-4%			3%			-4%			0%	
Total Lost time (s)	6.3	6.3	6.3	5.3	6.3	6.3	4.0	6.3	6.3	6.3	6.3	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1633	1719	1461	1577	1660	1411	1689	1778	1511	1770	1583	
Flt Permitted	0.30	1.00	1.00	0.09	1.00	1.00	0.65	1.00	1.00	1.00	1.00	
Satd. Flow (perm)	512	1719	1461	151	1660	1411	1147	1778	1511	1863	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	5	1000	163	130	848	22	288	5	250	11	0	5
RTOR Reduction (vph)	0	0	55	0	0	6	0	0	163	0	5	0
Lane Group Flow (vph)	5	1000	108	130	848	16	288	5	87	11	0	0
Heavy Vehicles (%)	9%	9%	9%	9%	9%	9%	9%	9%	9%	2%	2%	2%
Turn Type	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	Perm	NA	
Protected Phases		6		5	2		3	8			4	
Permitted Phases	6		6	2		2	8		8	4		
Actuated Green, G (s)	65.9	65.9	65.9	76.7	76.7	76.7	17.2	17.2	17.2	2.2	2.2	
Effective Green, g (s)	65.9	65.9	65.9	76.7	76.7	76.7	17.2	17.2	17.2	2.2	2.2	
Actuated g/C Ratio	0.62	0.62	0.62	0.72	0.72	0.72	0.16	0.16	0.16	0.02	0.02	
Clearance Time (s)	6.3	6.3	6.3	5.3	6.3	6.3	4.0	6.3	6.3	6.3	6.3	
Vehicle Extension (s)	3.0	3.0	3.0	0.2	3.0	3.0	3.0	0.2	0.2	0.2	0.2	
Lane Grp Cap (vph)	316	1063	904	182	1195	1016	241	287	244	38	32	
v/s Ratio Prot		c0.58		0.04	c0.51		c0.12	0.00			0.00	
v/s Ratio Perm	0.01		0.07	0.48		0.01	c0.07		0.06	0.01		
v/c Ratio	0.02	0.94	0.12	0.71	0.71	0.02	1.20	0.02	0.36	0.29	0.00	
Uniform Delay, d1	7.8	18.5	8.4	20.2	8.5	4.2	44.2	37.5	39.7	51.4	51.1	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.0	15.4	0.1	10.5	2.0	0.0	121.0	0.0	0.3	1.5	0.0	
Delay (s)	7.8	33.9	8.4	30.8	10.5	4.2	165.2	37.6	40.1	52.9	51.1	
Level of Service	A	C	A	C	B	A	F	D	D	D	D	
Approach Delay (s)		30.2			13.0			106.4			52.3	
Approach LOS		C			B			F			D	

Intersection Summary			
HCM 2000 Control Delay	39.2	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	106.5	Sum of lost time (s)	21.9
Intersection Capacity Utilization	93.2%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	25	1120	15	25	880	5	15	0	30	5	0	25
Sign Control		Free			Free			Stop			Stop	
Grade		3%			-4%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	1217	16	27	957	5	16	0	33	5	0	27
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		1058										
pX, platoon unblocked				0.42			0.42	0.42	0.42	0.42	0.42	
vC, conflicting volume	962			1234			2310	2288	1217	2315	2299	957
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	962			869			3420	3369	830	3433	3394	957
tC, single (s)	4.2			4.2			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.3			2.3			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	96			91			0	100	79	0	100	91
cM capacity (veh/h)	688			315			1	3	156	1	3	313

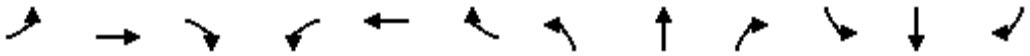
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	27	1217	16	27	957	5	49	33
Volume Left	27	0	0	27	0	0	16	5
Volume Right	0	0	16	0	0	5	33	27
cSH	688	1700	1700	315	1700	1700	4	7
Volume to Capacity	0.04	0.72	0.01	0.09	0.56	0.00	11.63	4.58
Queue Length 95th (ft)	3	0	0	7	0	0	Err	Err
Control Delay (s)	10.4	0.0	0.0	17.5	0.0	0.0	Err	Err
Lane LOS	B			C			F	F
Approach Delay (s)	0.2			0.5			Err	Err
Approach LOS							F	F

Intersection Summary				
Average Delay	349.9			
Intersection Capacity Utilization	70.5%	ICU Level of Service	C	
Analysis Period (min)	15			

Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	900	370	280	1180	15	160	0	65	15	5	15
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11	12	12	12	12	12	12
Grade (%)		-4%			3%			-4%			0%	
Total Lost time (s)	6.3	6.3	6.3	5.3	6.3	6.3	4.0		6.3	6.3	6.3	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00		0.85	1.00	0.89	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	1.00	
Satd. Flow (prot)	1633	1719	1461	1577	1660	1411	1689		1511	1770	1650	
Flt Permitted	0.11	1.00	1.00	0.09	1.00	1.00	0.53		1.00	1.00	1.00	
Satd. Flow (perm)	193	1719	1461	154	1660	1411	948		1511	1863	1650	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	5	978	402	304	1283	16	174	0	71	16	5	16
RTOR Reduction (vph)	0	0	122	0	0	3	0	0	63	0	16	0
Lane Group Flow (vph)	5	978	280	304	1283	13	174	0	8	16	5	0
Heavy Vehicles (%)	9%	9%	9%	9%	9%	9%	9%	9%	9%	2%	2%	2%
Turn Type	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt		Perm	Perm	NA	
Protected Phases		6		5	2		3	8			4	
Permitted Phases	6		6	2		2	8		8	4		
Actuated Green, G (s)	78.4	78.4	78.4	100.6	100.6	100.6	15.1		15.1	3.5	3.5	
Effective Green, g (s)	78.4	78.4	78.4	100.6	100.6	100.6	15.1		15.1	3.5	3.5	
Actuated g/C Ratio	0.61	0.61	0.61	0.78	0.78	0.78	0.12		0.12	0.03	0.03	
Clearance Time (s)	6.3	6.3	6.3	5.3	6.3	6.3	4.0		6.3	6.3	6.3	
Vehicle Extension (s)	3.0	3.0	3.0	0.2	3.0	3.0	3.0		0.2	0.2	0.2	
Lane Grp Cap (vph)	117	1050	892	308	1301	1106	155		177	50	45	
v/s Ratio Prot		0.57		0.13	c0.77		c0.07				0.00	
v/s Ratio Perm	0.03		0.19	c0.64		0.01	c0.07		0.01	0.01		
v/c Ratio	0.04	0.93	0.31	0.99	0.99	0.01	1.12		0.05	0.32	0.12	
Uniform Delay, d1	10.0	22.5	12.0	39.4	13.2	3.0	56.1		50.2	61.2	60.9	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	
Incremental Delay, d2	0.2	14.2	0.2	47.2	21.5	0.0	109.0		0.0	1.3	0.4	
Delay (s)	10.1	36.7	12.2	86.6	34.7	3.0	165.1		50.3	62.6	61.3	
Level of Service	B	D	B	F	C	A	F		D	E	E	
Approach Delay (s)		29.5			44.2			131.8			61.9	
Approach LOS		C			D			F			E	

Intersection Summary			
HCM 2000 Control Delay	44.7	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	1.08		
Actuated Cycle Length (s)	128.3	Sum of lost time (s)	21.9
Intersection Capacity Utilization	108.4%	ICU Level of Service	G
Analysis Period (min)	15		

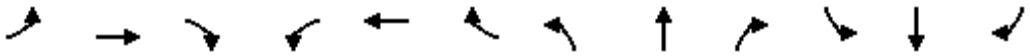
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	30	930	20	5	1365	15	30	0	45	5	0	90
Sign Control		Free			Free			Stop			Stop	
Grade		3%			-4%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	1011	22	5	1484	16	33	0	49	5	0	98
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		1058										
pX, platoon unblocked				0.43			0.43	0.43	0.43	0.43	0.43	
vC, conflicting volume	1500			1033			2668	2587	1011	2620	2592	1484
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1500			424			4189	4001	374	4076	4014	1484
tC, single (s)	4.2			4.2			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.3			2.3			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	92			99			0	100	83	0	100	36
cM capacity (veh/h)	427			477			0	1	292	0	1	153

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	33	1011	22	5	1484	16	82	103
Volume Left	33	0	0	5	0	0	33	5
Volume Right	0	0	22	0	0	16	49	98
cSH	427	1700	1700	477	1700	1700	0	8
Volume to Capacity	0.08	0.59	0.01	0.01	0.87	0.01	206.64	12.93
Queue Length 95th (ft)	6	0	0	1	0	0	Err	Err
Control Delay (s)	14.1	0.0	0.0	12.6	0.0	0.0	Err	Err
Lane LOS	B			B			F	F
Approach Delay (s)	0.4			0.0			Err	Err
Approach LOS							F	F

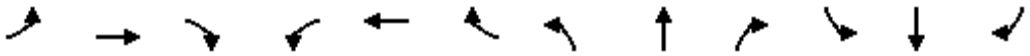
Intersection Summary				
Average Delay	670.7			
Intersection Capacity Utilization	89.6%	ICU Level of Service	E	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (vph)	5	1120	190	145	950	25	320	10	280	15	0	5
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	11	11	11	11	11	11	12	12	12	12	12	12
Grade (%)		-4%			3%			-4%			0%	
Total Lost time (s)	6.3	6.3	6.3	5.3	6.3	6.3	4.0	6.3	6.3	6.3	6.3	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.85	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1633	1719	1461	1577	1660	1411	1689	1778	1511	1770	1583	
Flt Permitted	0.19	1.00	1.00	0.04	1.00	1.00	0.53	1.00	1.00	1.00	1.00	
Satd. Flow (perm)	327	1719	1461	66	1660	1411	948	1778	1511	1863	1583	
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	5	1217	207	158	1033	27	348	11	304	16	0	5
RTOR Reduction (vph)	0	0	43	0	0	7	0	0	132	0	5	0
Lane Group Flow (vph)	5	1217	164	158	1033	20	348	11	172	16	0	0
Heavy Vehicles (%)	9%	9%	9%	9%	9%	9%	9%	9%	9%	2%	2%	2%
Turn Type	Perm	NA	Perm	pm+pt	NA	Perm	pm+pt	NA	Perm	Perm	NA	
Protected Phases		6		5	2		3	8			4	
Permitted Phases	6		6	2		2	8		8	4		
Actuated Green, G (s)	95.6	95.6	95.6	108.6	108.6	108.6	26.5	26.5	26.5	3.5	3.5	
Effective Green, g (s)	95.6	95.6	95.6	108.6	108.6	108.6	26.5	26.5	26.5	3.5	3.5	
Actuated g/C Ratio	0.65	0.65	0.65	0.74	0.74	0.74	0.18	0.18	0.18	0.02	0.02	
Clearance Time (s)	6.3	6.3	6.3	5.3	6.3	6.3	4.0	6.3	6.3	6.3	6.3	
Vehicle Extension (s)	3.0	3.0	3.0	0.2	3.0	3.0	3.0	0.2	0.2	0.2	0.2	
Lane Grp Cap (vph)	211	1112	945	127	1220	1037	265	319	271	44	37	
v/s Ratio Prot		0.71		c0.06	0.62		c0.17	0.01			0.00	
v/s Ratio Perm	0.02		0.11	c0.85		0.01	c0.07		0.11	0.01		
v/c Ratio	0.02	1.09	0.17	1.24	0.85	0.02	1.31	0.03	0.63	0.36	0.00	
Uniform Delay, d1	9.3	26.0	10.3	54.1	13.7	5.2	59.5	50.0	56.1	71.0	70.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.0	56.6	0.1	159.6	5.6	0.0	165.2	0.0	3.5	1.9	0.0	
Delay (s)	9.4	82.6	10.4	213.7	19.3	5.3	224.8	50.1	59.7	72.9	70.4	
Level of Service	A	F	B	F	B	A	F	D	E	E	E	
Approach Delay (s)		71.9			44.2			146.2			72.3	
Approach LOS		E			D			F			E	

Intersection Summary			
HCM 2000 Control Delay	76.6	HCM 2000 Level of Service	E
HCM 2000 Volume to Capacity ratio	1.31		
Actuated Cycle Length (s)	147.7	Sum of lost time (s)	21.9
Intersection Capacity Utilization	106.3%	ICU Level of Service	G
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Volume (veh/h)	30	1365	20	30	1070	10	20	0	40	5	5	30
Sign Control		Free			Free			Stop			Stop	
Grade		3%			-4%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	1484	22	33	1163	11	22	0	43	5	5	33
Pedestrians												
Lane Width (ft)												
Walking Speed (ft/s)												
Percent Blockage												
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (ft)		1058										
pX, platoon unblocked				0.36			0.36	0.36	0.36	0.36	0.36	
vC, conflicting volume	1174			1505			2812	2788	1484	2821	2799	1163
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	1174			1515			5105	5038	1455	5128	5068	1163
tC, single (s)	4.2			4.2			7.1	6.5	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.3			2.3			3.5	4.0	3.3	3.5	4.0	3.3
p0 queue free %	94			79			0	100	25	0	0	86
cM capacity (veh/h)	571			153			0	0	58	0	0	237

Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	NB 1	SB 1
Volume Total	33	1484	22	33	1163	11	65	43
Volume Left	33	0	0	33	0	0	22	5
Volume Right	0	0	22	0	0	11	43	33
cSH	571	1700	1700	153	1700	1700	0	0
Volume to Capacity	0.06	0.87	0.01	0.21	0.68	0.01	Err	403.52
Queue Length 95th (ft)	5	0	0	19	0	0	Err	Err
Control Delay (s)	11.7	0.0	0.0	34.7	0.0	0.0	Err	Err
Lane LOS	B			D			F	F
Approach Delay (s)	0.2			0.9			Err	Err
Approach LOS							F	F

Intersection Summary				
Average Delay	Err			
Intersection Capacity Utilization	86.0%	ICU Level of Service	E	
Analysis Period (min)	15			

Appendix C – Raw Crash Data

Date	Time		Milelog	IntersectingRoute	Injury Crash	Fatalities	MannerOfCollision	LocationOfImpact	FirstHarmfulEvent	Light	Surface	DirVeh1	MnvrVeh1	U1Factors	IntersectRouteType	DirVeh2	MnvrVeh2	U2Factors
1/30/2012	8:23:00	DULUTH HWY SR 120	0	NORTHMONT PKWY	0	0	Rear End	On Roadway	Motor Vehicle In Motion	Daylight	Dry	South	Straight	Following too Close		South	Straight	No Contributing Factors
1/30/2012	12:08:00	DULUTH SR 120 HWY	0	NORTHMONT PKWY	0	0	Rear End	On Roadway	Motor Vehicle In Motion	Daylight	Dry	East	Straight	Following too Close		East	Stopped	No Contributing Factors
2/8/2012	21:41:00	DULUTH SR 120 HWY	0	NORTHMONT PKWY	1	0	Rear End	On Roadway	Motor Vehicle In Motion	Dark-Not Lighted	Dry	East	Straight	Following too Close		East	Stopped	No Contributing Factors
7/16/2015	16:38:00	DULUTH HWY SR 120	5.02	NORTHMONT PKWY	1	0	Rear End	On Roadway	Motor Vehicle In Motion	Daylight	Dry	East	Straight	Following too Close		East	Stopped	No Contributing Factors
2/22/2015	13:33:00	2434 DULUTH HWY SR 120	5.02		0	0	Sideswipe-Same Direction	On Roadway	Motor Vehicle In Motion	Daylight	Wet	West	Straight	No Contributing Factors		West	Straight	No Contributing Factors
3/14/2013	22:13:00	2400 DULUTH SR 120 HWY NW	5.02	NORTHMONT PKWY	1	0	Head On	On Roadway	Motor Vehicle In Motion	Dark-Lighted	Dry	South	Turning Left	Failed to Yield		East	Straight	No Contributing Factors
7/2/2014	17:02:00	DULUTH HWY SR 120	5.02	NORTHMONT PKWY	0	0	Rear End	On Roadway	Motor Vehicle In Motion	Daylight	Dry	South	Straight	Following too Close		South	Stopped	No Contributing Factors
9/21/2014	13:51:00	DULUTH SR 120 HWY	5.02	NORTHMONT PKWY	0	0	Rear End	On Roadway	Motor Vehicle In Motion	Daylight	Dry	East	Straight	Following too Close		East	Stopped	No Contributing Factors
10/7/2014	7:31:00	DULUTH HWY SR 120	5.02	NORTHMONT PKWY	1	0	Rear End	On Roadway	Motor Vehicle In Motion	Daylight	Dry	West	Straight	Following too Close		West	Stopped	No Contributing Factors
#########	17:48:00	DULUTH SR 120 HWY	5.02	NORTHMONT PKWY	0	0	Rear End	On Roadway	Motor Vehicle In Motion	Dusk	Dry	East	Straight	Following too Close,Distracted		East	Stopped	No Contributing Factors
#########	19:06:00	DULUTH SR 120 HWY	5.02	NORTHMONT PKWY	0	0	Rear End	On Roadway	Motor Vehicle In Motion	Dark-Lighted	Wet	East	Straight	Following too Close,Weather Conditions		East	Straight	No Contributing Factors
#########	13:08:00	DULUTH HWY SR120	5.02	NORTHMONT PKWY	0	0	Rear End	On Roadway	Motor Vehicle In Motion	Daylight	Dry	East	Turning Right	Following too Close		East	Stopped	No Contributing Factors

Date	Time		Milelog	IntersectingRoute	Injury Crash	Fatalities	MannerOfCollision	LocationOfImpact	FirstHarmfulEvent	Light	Surface	DirVeh1	MnvrVeh1	U1Factors	IntersectRouteType	DirVeh2	MnvrVeh2	U2Factors
12/9/2014	9:59:00	DULUTH HWY	5.02	NORTHMONT PKWY	1	0	Rear End	On Roadway	Motor Vehicle In Motion	Daylight	Dry	South	Straight	Following too Close		South	Stopped	No Contributing Factors
1/15/2015	17:28:00	DULUTH SR 120 HWY	5.02	NORTHMONT PKWY	0	0	Rear End	On Roadway	Motor Vehicle In Motion	Dusk	Wet	East	Straight	Following too Close,Weather Conditions		East	Stopped	No Contributing Factors
1/23/2015	8:05:00	DULUTH SR 120 HWY	5.02	NORTHMONT PKWY	0	0	Rear End	On Roadway	Motor Vehicle In Motion	Daylight	Wet	West	Straight	Following too Close		West	Straight	No Contributing Factors
2/5/2015	18:39:00	DULUTH SR 120 HWY	5.02	NORTHMONT PKWY	0	0	Rear End	On Roadway	Motor Vehicle In Motion	Dark-Lighted	Dry	North	Straight	Following too Close		North	Stopped	No Contributing Factors
4/13/2015	3:00:00	DULUTH SR 120 HWY NW	5.02	NORTHMONT PKWY	0	0	Angle	On Roadway	Deer	Dark-Not Lighted	Dry	East	Straight	Object Or Animal,Distracted				
4/26/2015	11:13:00	SR 120	5.02	NORTHMONT PKWY	1	0	Angle	On Roadway	Motor Vehicle In Motion	Daylight	Dry	West	Straight	Driver Lost Control				
6/2/2015	19:15:00	DULUTH SR 120 HWY	5.02	NORTHMONT PKWY	0	0	Rear End	On Roadway	Motor Vehicle In Motion	Daylight	Dry	West	Straight	Following too Close		West	Stopped	No Contributing Factors
6/17/2015	21:10:00	DULUTH HWY SR120	5.02	NORTHMONT PKWY	0	0	Rear End	On Roadway	Motor Vehicle In Motion	Daylight	Dry	East	Straight	Following too Close		East	Stopped	No Contributing Factors
7/16/2015	9:11:00	SR 120	5.02	NORTHMONT PKWY	0	0	Rear End	On Roadway	Motor Vehicle In Motion	Daylight	Dry	West	Straight	Following too Close		West	Straight	No Contributing Factors
5/8/2015	17:38:00	DULUTH SR 120 HWY	5.02	NORTHMONT PKWY	0	0	Rear End	On Roadway	Motor Vehicle In Motion	Daylight	Dry	North	Straight	Following too Close		North	Straight	No Contributing Factors
2/28/2010	12:19:00	DULUTH SR 120 HWY	5.02	NORTHMONT PKWY	0	0	Sideswipe-Same Direction	On Roadway	Motor Vehicle In Motion	Daylight	Dry	North	Making U-turn	Failed to Yield		North	Straight	No Contributing Factors
3/10/2010	20:06:00	DULUTH SR 120 HWY	5.02	NORTHMONT PKWY	0	0	Rear End	On Roadway	Motor Vehicle In Motion	Dark-Not Lighted	Wet	East	Straight	Following too Close		East	Stopped	No Contributing Factors

Date	Time		Milelog	IntersectingRoute	Injury Crash	Fatalities	MannerOfCollision	LocationOfImpact	FirstHarmfulEvent	Light	Surface	DirVeh1	MnvrVeh1	U1Factors	IntersectRouteType	DirVeh2	MnvrVeh2	U2Factors
5/7/2011	15:14:00	DULUTH SR 120 HWY	5.02	NORTHMONT PKWY	1	0	Rear End	On Roadway	Motor Vehicle In Motion	Daylight	Dry	East	Straight	Following too Close		East	Straight	No Contributing Factors
6/8/2012	21:17:00	DULUTH HIGHWAY SR120 2400	5.03	NORTHMONT PKWY	1	0	Rear End	On Roadway	Motor Vehicle In Motion	Dark-Lighted	Dry	East	Straight	Following too Close		East	Stopped	No Contributing Factors
6/12/2012	5:30:00	DULUTH SR 120, HWY	5.03	NORTHMONT PKWY	0	0	Rear End	On Roadway	Motor Vehicle In Motion	Dark-Lighted	Wet	West	Straight	Following too Close,Misjudged Clearance		West	Straight	No Contributing Factors
6/16/2012	19:53:00	DULUTH HWY S R 120 NW	5.03	NORTHMONT PKWY	0	0	Sideswipe-Same Direction	On Roadway	Motor Vehicle In Motion	Daylight	Dry	East	Changing Lanes	Changed Lanes Improperly, Inattentive		East	Straight	No Contributing Factors
6/25/2012	15:19:00	DULUTH SR 120 HWY	5.03	NORTHMONT PKWY	0	0	Angle	On Roadway	Motor Vehicle In Motion	Dark-Lighted	Dry	East	Turning Left	Failed to Yield		West	Straight	No Contributing Factors
7/27/2012	18:24:00	DULUTH SR 120 HWY	5.03	NORTHMONT PKWY	1	0	Rear End	On Roadway	Motor Vehicle In Motion	Daylight	Dry	West	Straight	Following too Close		West	Stopped	No Contributing Factors
4/25/2012	15:59:00	DULUTH HWY SR 120	0	NORTHMONT PKWY	0	0	Not A Collision with Motor Vehicle	Off Roadway	Motor Vehicle In Motion	Daylight	Dry	West	Straight	Driver Lost Control				
4/28/2012	15:47:00	SR 120	0	NORTHMONT PKWY	0	0	Rear End	On Roadway	Motor Vehicle In Motion	Daylight	Dry	West	Straight	Following too Close		West	Straight	No Contributing Factors
5/1/2014	19:19:00	DULUTH HWY SR 120	5.03	NORTHMONT PKWY	0	0	Rear End	On Roadway	Motor Vehicle In Motion	Daylight	Dry	North	Straight	Following too Close		North	Stopped	No Contributing Factors
5/29/2014	8:46:00	DULUTH SR 120 HWY	5.03	NORTHMONT PKWY	0	0	Sideswipe-Opposite Direction	On Roadway	Motor Vehicle In Motion	Daylight	Dry	West	Straight	Other		East	Straight	Other
5/13/2014	17:09:00	DULUTH SR 120 HWY	5.03	NORTHMONT PKWY	0	0	Not A Collision with Motor Vehicle	On Roadway	Motor Vehicle In Motion	Daylight	Dry	East	Straight	Other				

Date	Time		Milelog	IntersectingRoute	Injury Crash	Fatalities	MannerOfCollision	LocationOfImpact	FirstHarmfulEvent	Light	Surface	DirVeh1	MnvrVeh1	U1Factors	IntersectRouteType	DirVeh2	MnvrVeh2	U2Factors
5/21/2014	16:01:00	DULUTH HWY	5.03	NORTHMONT PKWY	0	0	Rear End	On Roadway	Motor Vehicle In Motion	Daylight	Dry	East	Straight	Following too Close		East	Stopped	No Contributing Factors
9/17/2010	14:47:00	2444 DULUTH HWY SR 120	5.03	NORTHMONT PKWY	1	0	Rear End	On Roadway	Motor Vehicle In Motion	Daylight	Dry	East	Straight	Following too Close,Mechanical Or Vehicle Failure		East	Straight	No Contributing Factors
4/21/2010	12:46:00	DULUTH HWY SR 120	5.03	NORTHMONT PKWY	0	0	Rear End	On Roadway	Motor Vehicle In Motion	Daylight	Dry	East	Straight	Following too Close		East	Stopped	No Contributing Factors
8/19/2010	6:15:00	DULUTH HWY	5.03	NORTHMONT PKWY	1	0	Angle	Off Roadway	Motor Vehicle In Motion	Dark-Lighted	Dry	West	Straight	Distracted				
10/5/2010	8:52:00	DULUTH SR 120 HWY	5.03	NORTHMONT PKWY	0	0	Rear End	On Roadway	Motor Vehicle In Motion	Daylight	Dry	West	Stopped	No Contributing Factors		West	Straight	Following too Close
#########	7:30:00	DULUTH HIGHWAY SR 120	5.03	NORTHMONT PKWY	0	0	Rear End	On Roadway	Motor Vehicle In Motion	Daylight	Wet	East	Straight	Following too Close		East	Straight	No Contributing Factors
3/15/2011	7:22:00	DULUTH SR 120 HWY	5.03	NORTHMONT PKWY	1	0	Angle	On Roadway	Motor Vehicle In Motion	Dawn	Wet	South	Turning Left	Failed to Yield		East	Straight	No Contributing Factors
#########	8:02:00	SR 120	0	NORTHMONT PKWY	1	0	Rear End	On Roadway	Motor Vehicle In Motion	Daylight	Wet	East	Straight	Following too Close		East	Straight	No Contributing Factors
9/6/2015	7:57:00	NORTHMONT PKWY AND DULUTH HWY	0		0	0	Not A Collision with Motor Vehicle	On Roadway	Motor Vehicle In Motion	Daylight	Dry	North	Straight					
8/29/2013	8:45:00	DULUTH SR 120 HWY	5.02	NORTHMONT PKWY	0	0	Rear End	On Roadway	Motor Vehicle In Motion	Daylight	Dry	East	Straight	Following too Close		East	Straight	No Contributing Factors
7/21/2013	11:04:00	HWY 120 DULUTH HWY	0	STAUNTON DR	0	0	Not A Collision with Motor Vehicle	On Roadway	Guard Rail Face	Daylight	Dry	East	Straight	Driver Lost Control				
6/3/2010	21:19:00	SR 120	0	STAUNTON DR	1	0	Angle	On Roadway	Motor Vehicle In Motion	Dark-Not Lighted	Dry							

Date	Time		Milelog	IntersectingRoute	Injury Crash	Fatalities	MannerOfCollision	LocationOfImpact	FirstHarmfulEvent	Light	Surface	DirVeh1	MnvrVeh1	U1Factors	IntersectRouteType	DirVeh2	MnvrVeh2	U2Factors
3/21/2012	19:15:00	DULUTH HWY	0	STAUNTON DR	1	0	Angle	On Roadway	Motor Vehicle In Motion	Daylight	Dry	North	Straight	Failed to Yield		West	Straight	No Contributing Factors
#########	4:39:00	DULUTH HWY NW	5.23	STAUNTON DR	1	0	Angle	On Roadway	Motor Vehicle In Motion	Dark-Not Lighted	Dry	North	Turning Left	Failed to Yield		West	Straight	No Contributing Factors
12/3/2011	19:31:00	DULUTH HWY SR 120	5.23	STAUNTON DR	0	0	Not A Collision with Motor Vehicle	On Roadway	Deer	Dark-Not Lighted	Dry	East	Straight	No Contributing Factors				
3/15/2013	4:43:00	DULUTH HIGHWAY SR 120	5.23	STAUNTON DR	0	0	Head On	On Shoulder	Guard Rail End	Dark-Not Lighted	Dry	West	Straight	Driver Lost Control,Changed Lanes Improperly,Driver Condition				
4/17/2013	7:54:00	DULUTH HIGHWAY 2370 SR 120	5.23	STAUNTON DR	0	0	Rear End	On Roadway	Motor Vehicle In Motion	Daylight	Dry	West	Straight	Following too Close		West	Straight	No Contributing Factors
11/8/2013	12:02:00	DULUTH SR 120 HWY	0	STAUNTON DR	0	0	Angle	On Roadway	Motor Vehicle In Motion	Daylight	Dry	West	Turning Left	Failed to Yield		South	Turning Left	
3/8/2014	7:23:00	DULUTH SR 120 HWY	0	STAUNTON DR	0	0	Head On	On Roadway	Guard Rail Face	Daylight	Dry	West	Straight	Driver Lost Control,Inattentive				
3/12/2014	16:28:00	DULUTH HWY SR 120	0	STAUNTON DR	0	0	Angle	On Roadway	Motor Vehicle In Motion	Daylight	Dry	East	Making U-turn	Improper Turn		West	Straight	No Contributing Factors
3/14/2014	8:19:00	DULUTH SR 120 HWY	0	STAUNTON DR	0	0	Rear End	On Roadway	Motor Vehicle In Motion	Daylight	Dry	East	Straight	Following too Close		East	Straight	No Contributing Factors
5/24/2014	16:11:00	DULUTH HWY	0	STAUNTON DR	0	0	Not A Collision with Motor Vehicle	On Shoulder	Guard Rail End	Daylight	Dry	West	Straight	No Contributing Factors		West	Straight	No Contributing Factors
6/22/2014	10:24:00	DULUTH HWY SR 120	0	STAUNTON DR	1	0	Rear End	On Roadway	Motor Vehicle In Motion	Daylight	Dry	West	Straight	Following too Close		West	Stopped	No Contributing Factors

Date	Time		Milelog	IntersectingRoute	Injury Crash	Fatalities	MannerOfCollision	LocationOfImpact	FirstHarmfulEvent	Light	Surface	DirVeh1	MnvrVeh1	U1Factors	IntersectRouteType	DirVeh2	MnvrVeh2	U2Factors
8/4/2014	9:02:00	DULUTH HWY SR 120	0	STAUNTON DR	0	0	Angle	On Roadway	Motor Vehicle In Motion	Daylight	Dry	South	Turning Left	Failed to Yield		West	Straight	No Contributing Factors
4/22/2011	15:42:00	DULUTH HWY	0	STAUNTON DR	0	0	Rear End	On Roadway	Motor Vehicle In Motion	Daylight	Wet	East	Straight	Following too Close		East	Straight	No Contributing Factors
#########	7:21:00	DULUTH HWY SR120	0	STAUNTON DR	0	0	Rear End	On Roadway	Motor Vehicle In Motion	Daylight	Dry	West	Straight	Following too Close		West	Straight	No Contributing Factors
4/21/2014	8:11:00	DULUTH HWY S R 120	0	STAUNTON DR	0	0	Rear End	On Roadway	Motor Vehicle In Motion	Daylight	Dry	West	Straight	Following too Close,Distracted		West	Stopped	No Contributing Factors
#########	17:35:00	DULUTH SR 120 HWY	0	NORTHMONT PKWY	0	0	Rear End	On Roadway	Motor Vehicle In Motion	Dark-Lighted	Wet	East	Straight	Following too Close		East	Stopped	No Contributing Factors
#########	15:31:00	SR 120	0	NORTHMONT PKWY	1	0	Rear End	On Roadway	Motor Vehicle In Motion	Daylight	Dry	East	Straight	Following too Close		East	Stopped	No Contributing Factors
9/6/2013	17:23:00	SR 120	5.02	NORTHMONT PKWY	1	0	Rear End	On Roadway	Motor Vehicle In Motion	Daylight	Dry	East	Straight	Following too Close		East	Stopped	No Contributing Factors
5/5/2010	13:49:00	DULUTH HWY SR 120	0	NORTHMONT PKWY	0	0	Sideswipe-Opposite Direction	On Roadway	Motor Vehicle In Motion	Daylight	Dry	North	Straight	Other		North	Straight	No Contributing Factors
2/6/2015	8:20:00	DULUTH HWY SR120	5.02	NORTHMONT PKWY	1	0	Rear End	On Roadway	Motor Vehicle In Motion	Daylight	Dry	East	Straight	Following too Close		East	Stopped	No Contributing Factors
2/6/2015	8:21:00	DULUTH HWY SR120	5.02	NORTHMONT PKWY	1	0	Rear End	On Roadway	Motor Vehicle In Motion	Daylight	Dry	East	Stopped	No Contributing Factors		East	Stopped	No Contributing Factors
9/18/2015	11:16:00	SR 120 DULUTH HWY SR 120 HWY	0	NORTHMONT PKWY	0	0	Angle	On Roadway	Motor Vehicle In Motion	Daylight	Dry	East	Turning Right	Improper Turn		East	Straight	No Contributing Factors
9/28/2015	16:22:00	SR 120 DULUTH HWY SR 120 HWY	0	NORTHMONT PKWY	0	0	Rear End	On Roadway	Motor Vehicle In Motion	Daylight	Wet	North	Straight	Following too Close		North	Straight	No Contributing Factors

Processed Date:5/20/2015

Parameters: Bridge Serial Num

Bridge Inventory Data Listing

Structure ID:135-0023-0 **Gwinnett** **SUFF. RATING: 58.70**

Location & Geography

Structure ID:	135-0023-0
200 Brdge Information:	06
*6A Feature Int: *6B Critical Bridge:	SINGLETON CREEK
*7A Route No Carried:	SR00120
*7B Facility Carried:	DULUTH HIGHWAY
9 Location:	1.5 MI E OF DULUTH
2 Dot District:	4841100000 - D1 DISTRICT ONE GAINESVILLE
207 Year Photo:	2014
*91 Inspection Frequency:	24 Date: 01/31/2014
92A Fract Crit Insp Freq:	0 Date: 02/01/1901
92B Underwater Insp Freq:	00 Date: 02/01/1901
92C Other Spc. Insp Freq:	00 Date: 02/01/1901
* 4 Place Code:	00000
*5 Inventory Route(O/U):	1
Type:	3 - State
Designation:	1- Mainline
Number:	00120
Direction:	0. Not applicable
*16 Latitude:	33.0000- 58.7214 HMMS Prefix:SR
*17 Longtitude:	84.0000- 6.5700 HMMS Suffix:120
	MP: 5.13
98 Border Bridge:	% Shared:00
99 ID Number:	000000000000000
*100 STRAHNET:	0- The Feature is not a STRAHNET route.
12 Base Highway Network:	1
13A LRS Inventory Route:	1351012000
13B Sub Inventory Route:	0.00
*101 Parallel Structure:	N. No parallel structure exists
*102 Direction of Traffic:	2- Two Way
*264 Road Inventory Mile Post:	005.13
*208 Inspection Area:	Area 07 Initials: JPD
Engineer's Initials:	jpd
* Location ID No:	135-00120D-005.13E

*104 Highway System:	0- Inventory Route is not on the NHS
*26 Functional Classification:	16- Urban - Minor Arterial
*204 Federal Route Type:	F - Primary. No: 01891
105 Federal Lands Highway:	0. Not applicable
*110 Truck Route:	0
206 School Bus Route:	1
217 Benchmark Elevation:	0000.00
218 Datum:	0- Not Applicable
*19 Bypass Length:	2
*20 Toll:	3- On a Free Road or Non-Highway
*21 Maintanance:	01-State Highway Agency.
*22 Owner:	01-State Highway Agency.
*31 Design Load:	2- H 15
37 Historical Significance:	5- Not eligible for the National Register of Historic Places
205 Congressional District:	7 - SEVEN
27 Year Constructed:	1938
106 Year Reconsrtucted:	0
33 Bridge Median	0-None
34 Skew:	20
35 Structure Flared:	No
38 Navigation Control:	0- Navigation is not controlled by an Agency
213 Special Steel Design:	0- Not applicable or other
267 Type of Paint:	5- Waterborne System (Type VI or VII)
*42 Type of Service On:	1-Highway
Type of Service Under:	5-Waterway
214 Movable Bridge:	0
203 Type Bridge:	A- Spread - O. Concrete M. Steel - O. Concrete
259 Pile Encasement	3
*43 Structure Type Main:	4-Steel (Continuous) 2-Stringer/Multi-Beam or Girder
45 No.Spans Main:	3
44 Structure Type Appr:	0- Other 0- Other
46 No Spans Appr:	0
226 Bridge Curve Horz	0 Vert: 0.00
111 Pier Protection	N - Navigation Control item coded 0, or Feature not a waterway
107 Deck Structure Type:	
108 Wearing Structure Type:	
Membrane Type:	
Deck Protection:	

Signs & Attachments

225 Expansion Joint Type:	02- Open or sealed concrete joint (silicone sealant)
242 Deck Drains:	1- Open Scuppers.
243 Parapet Location:	0- None present.
Height:	0.00
Width:	0.00
238 Curb Height:	1
Curb Material:	1- Concrete.
239 Handrail	1- Concrete. 1- Concrete.
*240 Median Barrier Rail:	0- None.
241 Bridge Median Height:	0
* Bridge Median Width:	0
230 Guardrail Loc. Dir. Rear:	3- Both sides.
Fwrd:	3- Both sides.
Oppo. Dir. Rear:	0- None.
Oppo. Fwrd:	0- None.
244 Aproach Slab	0- None.
224 Retaining Wall:	0- None.
233Posted Speed Limit:	50
236 Warning Sign:	1.00
234 Delineator:	1.00
235 Hazard Boards:	1
237 Utilities Gas:	00- Not Applicable
Water:	00- Not Applicable
Electric:	00- Not Applicable
Telephone:	00- Not Applicable
Sewer:	00- Not Applicable
247 Lighting Street:	0
Navigation:	0
Aerial:	0- Not a
*248 County Continuity No.:	00

Bridge Inventory Data Listing

Structure ID:135-0023-0

Programming Data

201 Project No: F-2661-B
202 Plans Available: 4- Plans in InfoImage.
249 Prop Proj No: BRST-189-1 (30)
250 Approval Status: 6102
251 PI Number: 132986-
252 Contract Date: 02/01/2007
260 Seismic No: 00000
75 Type Work: 34- Widening with deck 1- Work to be done by contract
94 Bridge Imp: Cost: $293
95 Roadway Imp. Cost: $29
96 Total Imp Cost: $440
76 Imp Length: 1397
97 Imp Year: 2013
114 Furure ADT: 30540 Year:2032

Hydralic Data

215Waterway Data:
High Water Elev: 0000.0 Year:1900
Flood Elev: 0000.0 Freq:00
Avg Streambed Elev: 0000.0
Drainage Area: 00000
Area of Opening: 000000
113 Scour Critical U. No Load Rating; no scour critical data entered.
216 Water Depth: 2.4 Br.Height:11
222 Slope Protection: 0
221Spur Dikes Rear 0 Fwd:0
219 Fender System 0- None.
220 Dolphin:
223 Culvert Cover: 000
Type: 0- Not Applicable
No. Barrels: 0
Width: 0.00 Height:0
Length: 0 Apron:0
*265 U/W Insp. Area 0 Diver:ZZZ
*Location ID No: 135-00120D-005.13E

Measurements:

*29 ADT 20360 Year:2012
109 %Trucks: 1
* 28 Lanes On: 2 Under:0
210 No. Tracks On: 00 Under:00
* 48 Max. Span Length 25
* 49 Structure Length: 75
51 Br. Rwdy. Width 23.90
52 Deck Width: 26.50
* 47 Tot. Horiz. Cl: 24
50 Curb / Sidewalk Width 0.00 / 0.00
32 Approach Rdwy. Width 40
*229 Shoulder Width:
Rear Lt: 2.00 Type:3 - Rt:7
Fwd. Lt: 2.00 Type:2 - Rt:2
Pavement Width:
Rear: 32.00 Type: 2- Asphalt.
36.00 Type: 2- Asphalt.
Intersaction Rear: 1 Fwd: 0
36Safety Features Br. Rail: 2- Inspected feature meets acceptable construction date standards.
Transition: 2- Inspected feature meets acceptable construction date standards.
App. G. Rail: 2- Inspected feature meets acceptable construction date standards.
App. Rail End: 2- Inspected feature meets acceptable construction date standards.
53 Minimum Cl. Over: 99'99"
Under: N- Feature not a highway or railroad. 0.00'0.00"
*228 Minimum Vertical Cl
Act. Odm Dir:: 99 ' 99"
Oppo. Dir: 99' 99"
Posted Odm. Dir: 00' 00"
Oppo. Dir: 00'00 "
55 Lateral Undercl. Rt: N- Feature not a highway or railroad. 0.00
56 Lateral Undercl. Lt: 0.00
*10 Max Min Vert Cl: 99' 99" Dir:0
39 Nav Vert Cl: 000 Horiz:0
116 Nav Vert Cl Closed: 000
245 Deck Thickness Main 7.00
Deck Thick Approach: 0.00
246 Overlay Thickness: 5.00
212 Year Last Painted: Sup:2000 Sub:0000

65 Inventory Rating Method: 2-Allowable Stress (AS)
63 Operating Rating Method: 2-Allowable Stress (AS)
66 Inventory Type: 2 - HS loading. Rating: 22
64 Operating Type: 2 - HS loading. Rating: 35
231Calculated Loads:
H-Modified: 20 0
HS-Modified: 25 0
Type 3: 26 0
Type 3s2: 40 0
Timber: 35 0
Piggyback: 40 0
261 H Inventory Rating: 15
262 H Operating Rating 21
67 Structural Evaluation: 6
58 Deck Condition: 7 - Good Condition
59 Superstructure Condition: 7 - Good Condition
* 227 Collision Damage: 0
60A Substructure Condition: 6 - Satisfactory Condition
60B Scour Condition: 8 - Very Good Condition
60C Underwater Condition N - Not Applicable
71 Waterway Adequacy: 8-Equal to present desirable criteria.
61 Channel Protection Cond.: 8
68 Deck Geometry: 2
69 UnderClr. Horz/Vert: N
72 Appr. Alignment: 6-Minor reduction of vehicle operating speed required.
62 Culvert: N - Not Applicable

Posting Data

70 Bridge Posting Required 5. Equal to or above legal loads
41 Struct Open, Posted, CL: A. Open, no restriction
* 103 Temporary Structure: 0
232 Posted Loads
H-Modified: 00
HS-Modified: 00
Type 3: 00
Type 3s2: 00
Timber: 00
Piggyback 00
253 Notification Date: 02/01/1901
258 Fed Notify Date: 02/01/1901

MS4 CONCEPT LAYOUT

Drainage Area	Pre Area	Pre C	Post Area	Post C	SF of Pavement Added
1	1.43	0.47	1.23	0.49	0
2	3.18	0.64	3.38	0.62	-675
3	1.95	0.55	2.37	0.52	287
4	1.53	0.51	1.10	0.56	-1355
5	0.46	0.57	0.56	0.59	2069

Michael Baker
INTERNATIONAL
420 TECHNOLOGY PKWY, STE 150
NORCROSS, GEORGIA 30092
(770) 263-9188

REPORT

Pavement Evaluation Summary

P.I. No. 132986
SR 120
Over Singleton Creek
Gwinnett County
Georgia

Project Number
2015.0535.01

October 2, 2015

FINAL DRAFT

We're here for you
UNITED CONSULTING

We're here for you
UNITED CONSULTING

Gwinnett County
P.I. No. 132986

October 2, 2015

Mr. Ben Clopper, P.E
Michael Baker International
420 Technology Parkway
Suite 150
Norcross, Georgia 30092

Via Email: Ben.Clopper@mbakerintl.com

PROJECT: Report of Pavement Evaluation Summary
P.I. No. 132986
SR 120 Over Singleton Creek
Gwinnett County, Georgia
UC Project No. **2015.0535.01**

Dear Mr. Clopper:

United Consulting is pleased to submit this report of the Pavement Evaluation Summary for the above referenced project site. We appreciate the opportunity to assist you with this project and look forward to working with you on future projects. If you have any questions regarding this report, or if we can of further assistance, please feel free to contact us.

Sincerely,

UNITED CONSULTING

Lonnie Rucker

Lonnie Rucker, E.I.T.
Staff Engineer

Ray E. Halbert P.E.

Ray E. Halbert, P.E.
Senior Geotechnical Engineer

GEORGIA REGISTERED N° 20064 PROFESSIONAL ENGINEER SANTANU SINHAROY

Santanu Sinharoy, P.E.
Chief Geotechnical Engineer
Registration No. 20064

LR/REH/SS/nj

H:\GEOTECHNICAL\REPORTS\2015\2015.0535.01 SR 120 at Singleton Creek\2015 0535 01 pes DRAFT.doc

FINAL DRAFT

PAVEMENT EVALUATION SUMMARY
For
PI No. 132986
Gwinnett County, Georgia

1. *LOCATION / DESCRIPTION*

This project is for the roadway improvement and replacement of a bridge on SR 120 (Duluth Highway) over Singleton Creek. The proposed improvement will consist of realignment of the roadway to accommodate the new bridge over Singleton Creek. The relocation of SR 120 will consist of two, 12 ft wide lanes with 10 ft wide rural shoulders (2 ft paved). The total length of the project is about 0.34 miles. The project is located within the following station limits based on the preliminary drawing provided at the time of this survey. This project is located outside the city limits of Duluth and within Gwinnett County, Georgia.

Station to Station	Location
14+00± to 32+00±	SR 120

2. *PAVEMENT CONDITION SUMMARY*

SR 120 (Duluth Highway) (Sta. 14+00 to Sta. 20+90 and Sta. 26+28 to Sta. 32+00)

The areas proposed to be retained on SR 120 (Duluth Highway) are in poor to good condition based on the latest COPACES rating in 2014 and on the finding of our field observations. The pavement distresses and core conditions from this evaluation are summarized in Section 6 and Section 8 of this report.

Based on our opinion, the existing pavement can be overlaid provided it is milled 2.0 inches prior to overlaying.

For additional information resulting in the provided recommendations see "**Item 11 – Assumptions and Justification'** section for details.

3. *PAVEMENT RECOMMENDATION SUMMARY*

The following types of construction are recommended along the roadway improvement for **SR 120** and associated Side Roads.

Road	Station to Station	Description	Type of Construction
SR 120	14+00± to 20+90±	Exist/ Widening	Inlay/ Overlay Construction, Full depth Construction for widening
	20+90± to 26+28±	New Alignment and Bridge	Full Depth Construction and Replacement
	26+28± to 32+00±	Exist/ Widening	Inlay/ Overlay Construction, Full depth Construction for widening
All Side Roads	Pavement Evaluation is Excluded from our scope of work		

Notation:
Inlay/Overlay Construction = Existing roadway, overlay conditions are acceptable.
Full Depth Construction = Widening, new roadway and/or alignment.
Full Depth Reconstruction = Existing roadway pavement is acceptable for overlay; however, the roadway is not part of the functional roadway. This section can remain in place if desired. Full Depth Replacement = Existing Roadway cannot accommodate overlay due to the existing effective structural number or due to new profile. Extension of the main line Full Depth Construction to the turnouts of the side roads is recommended

4. *FULL-DEPTH SECTIONS*

The following full-depth pavement structures are recommended for use on this project.

SR 120 Full Depth Design

(With Curb & Gutter) (Station 14+00 to Station 32+00 except bridge)				
PAY ITEM NUMBER	**MATERIAL**	**COURSE**	**THICKNESS**	**SPREAD RATE**
402-4510	12.5 mm Superpave including polymer modified AC	Surface	1.50 inches	165 lbs/yd^2
402-3190	19 mm Superpave	Binder	2.00 inches	220 lbs/yd^2
402-3121	25 mm Superpave	Asphalt Base	6.00 inches	660 lbs/yd^2
310-1101	Graded Aggregate Base	Base	12.00 inches	N/A

5. *OVERLAY SECTIONS*

We recommend that the existing pavement along the following roadways be milled and inlayed/ overlaid to remove existing cracked asphalt as follows:

- SR 120 from Station 14+00± to Station 20+90± be partially milled 2.00 inches.
- SR 120 from Station 20+90± to Station 32+00± be partially milled 2.00 inches.

SR 120 Mill and Overlay Design*

(With Curb & Gutter) (Station 14+00 to 20+90 and Station 26+28 to 32+00)				
PAY ITEM NUMBER	**MATERIAL**	**COURSE**	**THICKNESS**	**SPREAD RATE**
402-4510	12.5 mm Superpave including polymer modified AC	Surface	1.50 inches	165 lbs/yd^2
402-3190	19 mm Superpave	Binder	2.00 inches	220 lbs/yd^2
402-3121	25 mm Superpave	Asphalt Base	3.00 inches	330 lbs/yd^2

*Additional quantities (e.g., around sta. 29+38±) should be set up for extra milling depth.

Please refer to **Section 11 "Assumptions and Justification**" section of the report.

6. *PAVEMENT DISTRESSES*

Except for the following, no other significant distresses were encountered during the field exploration of this project:

Load Cracking On **SR 120,** predominantly Level 1 with occasional Level 2 load cracking was observed within the evaluated sections.

Block/ Transverse Cracking On **SR 120,** predominantly Level 1 block cracking was observed within the evaluated sections.

7. *COPACES/PACES*

The "Final Pavement Evaluation" typically includes a pavement surface distress survey utilizing the GDOT Pavement Condition Evaluation System (PACES). However, the project being small and majority being of new construction, PACES study is excluded. The Georgia Department of Transportation conducted PACES rating on the stretch of SR 120 between Mile Marker (MM) 4.94 and MM 5.28. In 2014, the rating for SR 120 for MM 0.0 to MM 5.7 according to the Assistant Area Maintenance Engineer for the Georgia Department of Transportation District 1, Area 1 was 80%.

8. CORES

Cores were recovered from seven (7) separate locations in the travel lanes and turn lanes of this project to determine the thicknesses and condition of the existing pavement sections. The results of the coring operation are tabulated below:

Core/ Sample Number	Location	Station/Direction/ Location	Asphalt Core Length (inches)	Core Condition	Underlying Material Type/ Thickness
C-1	**SR 120**	**Station 14+41** WB, Ln 1, 13' Lt, PW	5.50	Fair, vertical crack from 0.0" to 1.25", Coarse mix from 4.00" to 5.75.	Concrete=7.75", Compacted Soil and Gravel=6"
C-2	**SR 120**	**Station 16+18** EB, Ln 1, 18' Rt, PW	18.00	Good, diagonal crack from 2.5" to 3.5", horizontal crack with some missing asphalt at 14.25" to 15.75".	Compacted Soil and Gravel=6"
C-3	**SR 120**	**Station 18+38** EB, RTL, 43' Rt, DW	7.50	Good, minor (1.5"± long) horizontal crack at 2.5".	GAB=8.5"
C-4	**SR 120**	**Station 19+21** WB, Ln 1, 27.25' Lt, PW	9.00	Good, vertical crack from 0.0" to 1.75".	GAB=18.5"
C-5	**SR 120**	**Station 29+35** EB, RTL, 29.00' Rt, DW	9.00	Good. No visible stresses.	GAB=12"
C-6	**SR 120**	**Station 29+38** WB, Ln 1, 4.50' Lt, DW	21.00	Fair to poor, vertical crack from 0.0" to 3.0", horizontal delamination at 3.0", horizontal delamination with asphalt pieces from 10.5" to 12.5" (may have been resulted from coring activities).	Compacted Soil and Gravel=6"
C-7	**SR 120**	**Station 31+65** EB, Ln 1, 4.00' Rt, DW	10.00	Fair to poor, vertical crack from 0.0" to 2.0", horizontal delamination at 2.0", horizontal delamination between 7.0" and 7.5".	GAB=9.5"

Notation:
DW = Driver's Wheel Path
EB = Eastbound
GAB= Graded Aggregate Base
Ln = Designated Travel Lane
Lt = Left of the existing centerline, direction of travel (lower to higher station)
Rt = Right of the existing centerline, direction of travel (lower to higher station)
RTL = Right Turn Lane
PW = Passengers Wheel Path
WB = Westbound

9. *OTHER INFORMATION*

- The Soil Survey Summary for this project was not obtainable as of the issuance of this report. The attached pavement designs used the design values recommended in Appendix G and H of the GDOT Pavement Design Manual.

- The attached pavement designs used the design values recommended in the approved GDOT interdepartmental correspondence letter entitled, "Reviewed Summary of Design Traffic Projections Memorandum Document and Design Traffic Diagrams for SR 120/ Duluth Highway @ Singleton Creek 1.5 Mi E of Duluth", dated August 14, 2015 and the traffic information provided by Michael Baker International, dated August 11, 2015. See attached **Appendix G** – Traffic Data for further details.

- The full-depth design and the mill and inlay/overlay design analyses are attached to this report. All designs are based on a computer program named GDOT Pavement Design Version 2.0 developed by Georgia Department of Transportation, Pavement Management Branch.

- **Historical Information**

  The GDOT Geo TRAQS Historical Plans Research Website – Electronic Plans Search was reviewed to determine if any historical construction drawings were obtainable for evaluation. No additional historical information regarding previous pavement overlays, pavement management or construction dates were readily available for review for this project. In addition, United Consulting contacted the GDOT Office of Materials and Research for COPACES and any historical information regarding SR 120. GDOT responded, via telephone, the historical COPACES ratings for the segments requested.

- **Design Considerations for SR 120**
  - Number of lanes (in one-direction): 1
  - With curb and gutter
  - Provided Traffic Data: A.D.T. (2020): 13,300; (2040): 16,225
  - Provided Project Let Date: 2018
  - **TRAFFIC DATA**
    - A.D.T. (2020): 13,300 (One-Way)
    - A.D.T. (2040): 16,225 (One-Way)
    - Directional Distribution: 50/50
    - Lane Distribution: 100%
    - % 24 Hr. Trucks: 8%
    - % MU: 1.0%, % SU: 7.0%
    - Function Class: Urban Minor Arterial
    - Speed Design: ≤ 45 mph
    - Terminal Serviceability Index: 2.50
    - Soil Support: 2.5

- Regional Factor: 1.8
- Subgrade Reaction, k = 130 pci

- **Mill 2.0 inches** of the existing pavement for the project.

10. ADDITIONAL RECOMMENDATIONS

- We recommend a minimum 100 foot tie-in transition for SR 120 at the beginning and ending of the project. In addition, we recommend a minimum tie-in transition extended to the edge of turnouts for the side roads. The tie-in transition will consist of milling 2.00 inches and underlain by overlaying with 12.5 mm Superpave including polymer modified asphalt concrete mix and a 19 mm Superpave asphalt concrete mix.

- New pavements should be constructed flush with all existing and/ or new utility manholes or vaults.

- We recommend staggered joints for each asphalt concrete layer to reduce the potential moisture migration from subgrade soils.

- We recommend the application of a 2 foot wide pavement reinforcement fabric, centered on joints to reduce the potential for crack migration through the new asphalt.

- We recommend milling the asphaltic concrete pavement, as per Section 432 of the Standard Specifications.

- We recommend waterproofing the joints and cracks as the asphalt concrete pavement prior to the overlaying operation, as per Section 445 of the Standard Specifications.

- Full-Depth replacement/construction should be utilized where overlays do not conform to project specification vertical alignment requirements.

- After milling and immediately prior to inlaying/overlaying, we recommend that any surface cracks shall be sealed with a Type M crack sealant, as per Section 407 of the Standard Specifications.

11. ASSUMPTIONS AND JUSTIFICATIONS

- The provided pavement design is based on the traffic information provided by Michael Baker International**.** The traffic data provided was for a build/ no build for 2020 and 2040. The recommended LET DATE of 2018 plus 2 years indicated a design date for the years 2020 and 2040. The above pavement design used the 2020 and 2040 traffic data for assumption and justifications within this report.

- Based on the plans provided and the core samples taken, mill and overlay conditions are acceptable, if desired.

- Based on the plans provided, for Stations 20+90 to Station 26+28 on SR 120 full depth construction will be required due to the horizontal realignment. United Consulting did not perform pavement evaluation within this area.

- From near Station 14+00± to Station 20+90± and Station 26+28± to Station 32+00±, vertical alignment will be near or at the existing roadway. United Consulting recommend milling the existing surface at least 2.0 inches to remove the vertical load distresses within the existing roadway.

- No information regarding the Mile Marker was available on the website or in our field observations for Northmont Parkway or Staunton Drive.

- The station locations for SR 120 and all roadways associated with this project were not provided or staked in the field by a surveyor. United Consulting determined the approximate location of these stations by using a measuring wheel from the nearest identified stationary object marked on the provided plans.

12. LIMITATIONS

This report is for the exclusive use of the **Georgia Department of Transportation (GDOT),** its agents, and **Michael Baker International,** the designers of the project described herein, and may only be applied to this specific project. Our conclusions and recommendations have been prepared using generally accepted standards of Pavement Engineering practice in the State of Georgia and are valid for a period of two years from the issuance of this report. Should the implementation of the recommendations presented in this report be delayed more than two years, re-evaluation of the pavement should be performed. No other warranty is expressed or implied. Our firm is not responsible for conclusions, opinions or recommendations of others. The right to rely upon this report and the data within may not be assigned without **UNITED CONSULTING'S** written permission.

Our preliminary conclusions and recommendations are based upon design information furnished to us, data obtained from the previously described exploration and testing program and our past experience. They do not reflect variations in the conditions that may be present intermediate of our coring/ borings and in unexplored areas of the project. Should such variations become apparent during construction, it will be necessary to re-evaluate our conclusions and recommendations based upon "on-site" observations of the conditions.

Our conclusions and recommendation are based on out sit reconnaissance, anticipated existing pavement thickness, and our past experience. If the design or location of the project is changed, the recommendations contained herein, must be considered invalid unless our firm reviews the changes and our recommendations are either verified or modified in writing.

UNITED CONSULTING

Reported By: Lonnie Rucker

Reviewed By: Ray E. Halbert, P.E.

QC Reviewed By: Santanu Sinharoy, P.E.

Appendix A – Figures – (1 page)

Figure 1: Site Location Map and Asphalt Coring Location Plan

Appendix B – Project Photographs – (7 pages)

Appendix C – Roadway Photographs – (15 pages)

Appendix D – Example Photographs – (2 pages)

Appendix E – Core Photographs– (6 pages)

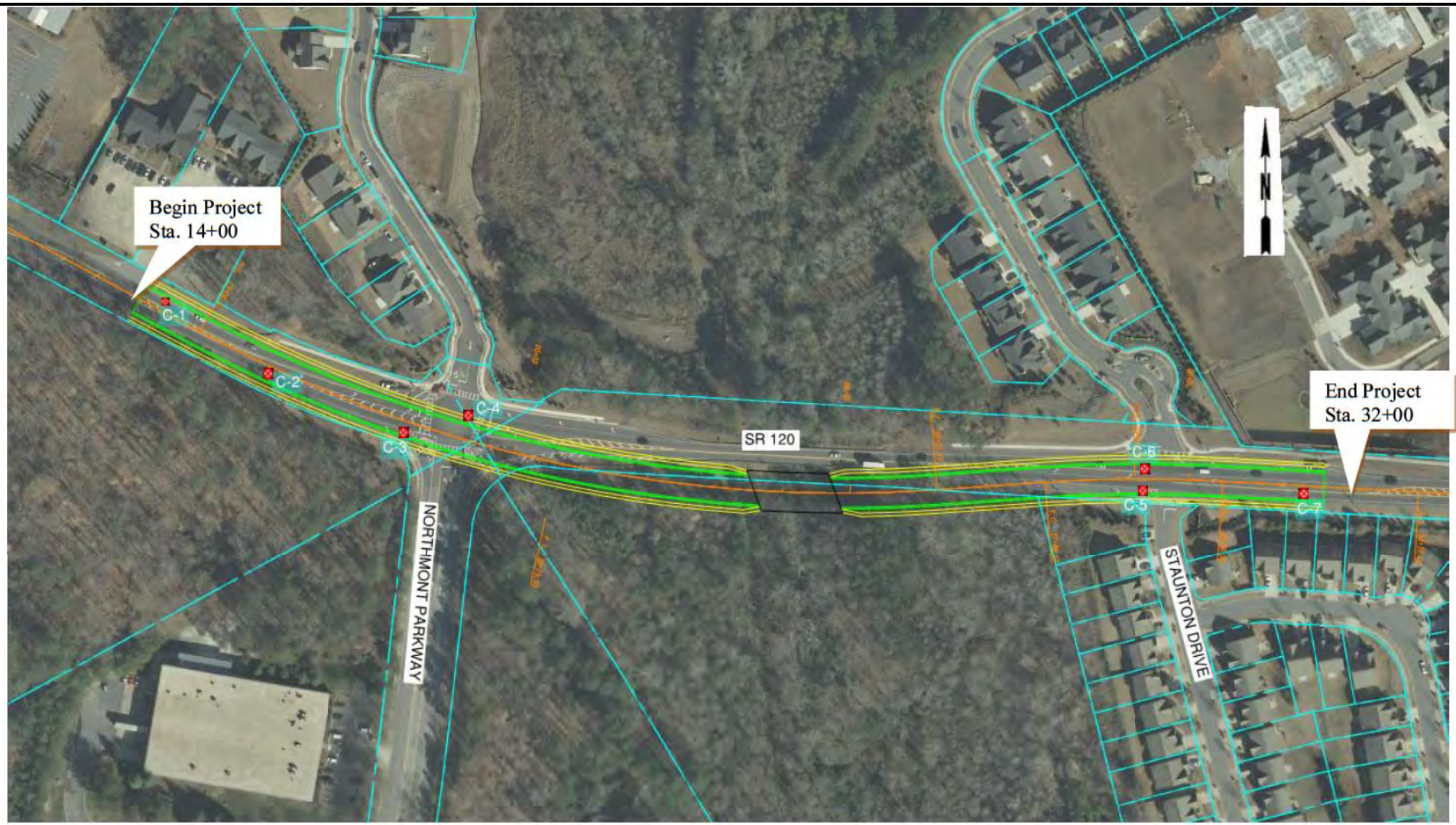
Appendix F – Pavement Rating – EXCLUDED

Appendix G – Recommended Pavement Section – (8 pages)
Approved Traffic Diagrams including approval letter (6 pages)
Full Depth Flexible Pavement Design using GAB with Curb and Gutter (1 page)
Inlay/ Overlay with Curb and Gutters – (1 page)

Appendix H – Roadway Survey and Core Properties – (4 pages)

Appendix I – Disc

APPENDIX A
FIGURES (1 PAGE)



SCALE: NTS	DATE: 06/25/2015	PROJECT NO: 2015.0535.01	TITLE: **PROJECT LOCATION MAP AND CORING LOCATION PLAN** S.R. 120 OVER SINGLETON CREEK P.I. No. 132986, Gwinnett County, Georgia
PREPARED: LR	CHECKED: REH	REVISIONS: 1	
CLIENT: **MICHAEL BAKER INTERNATIONAL**			UNITED CONSULTING 625 Holcomb Bridge Road, Norcross, GA 30071 Tel. 770/209-0029 FAX 770/582-2900 www.unitedconsulting.com *We're here for you* UNITED CONSULTING

FIG. 1

APPENDIX B

PROJECT PHOTOGRAPHS (7 PAGES)

PHOTOGRAPH LEGEND

Photograph Type	Label Protocol	Project Information
County Number	A three digit number	135
Route Number	A four digit number followed by a two character suffix (i.e., SR 120 = 0120 00)	0120 00 BU = Business 03 = City 00 = CR or SR
Route Code	State or County or other code route	1 = State Highway 2 = County Road 3 = City Street
Direction of Travel	E or W N or S	E = Eastbound W = Westbound N = Northbound S = Southbound
Milepost	MP	MP 4.94 to MP 5.28

135 0120 00 1 W AT STATION 15+00, MP= 4.96
SR 120, WESTBOUND

135 0120 00 1 E AT STATION 15+00, MP= 4.96
SR 120 EASTBOUND

135 0120 00 1 N AT STATION 19+10, MP= 5.03
SR 120, LOOKING NORTH ALONG NORTHMONT PKWY

135 0120 00 1 S AT STATION 19+00, MP= 5.03
SR 120, LOOKING SOUTH ALONG NORTHMONT PKWY

135 0120 00 1 W AT STATION 20+00, MP= 5.05
SR 120 WESTBOUND

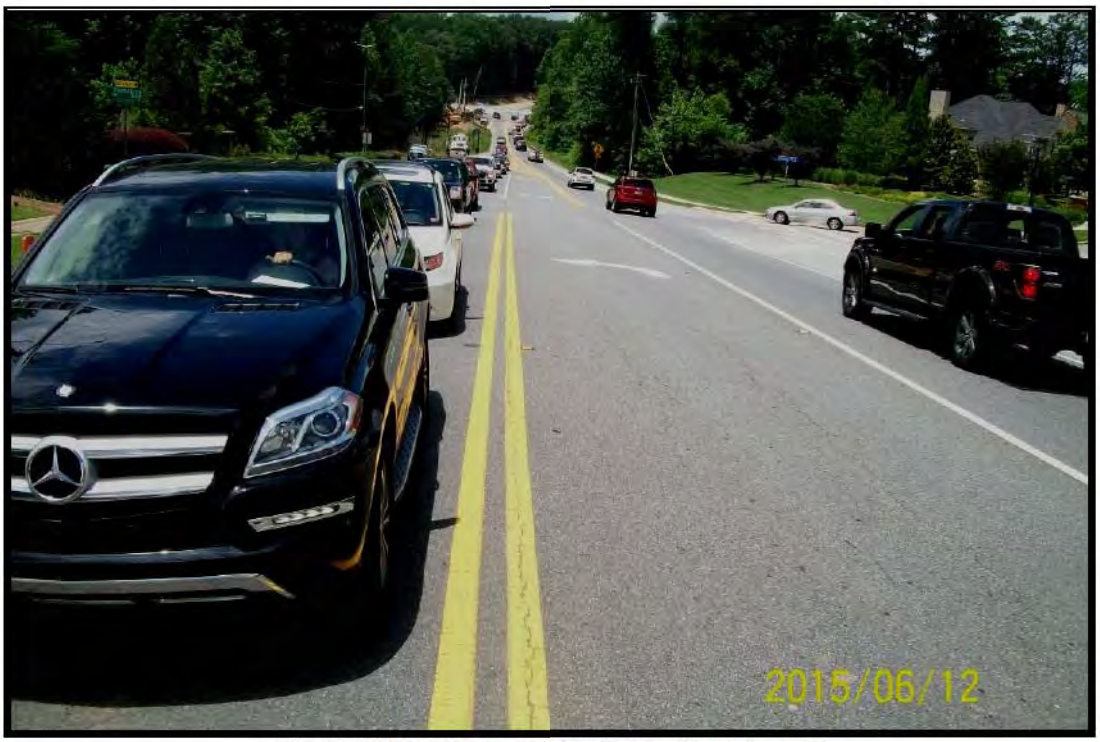
135 0120 00 E 1 AT STATION 20+00, MP= 5.05
SR 120 EASTBOUND

135 0120 00 1 W AT STATION 27+00, MP= 5.18
SR 120 WESTBOUND

135 0120 00 1 E AT STATION 27+00, MP= 5.18
SR 120 EASTBOUND

135 0120 00 1 N AT STATION 29+60, MP= 5.23
SR 120, LOOKING NORTH ALONG STAUNTON DRIVE

135 0120 00 1 N AT STATION 29+60, MP= 5.23
SR 120, LOOKING SOUTH ALONG STAUNTON DRIVE



135 0120 00 1 W AT STATION 31+00, MP= 5.26
SR 120 WESTBOUND

135 0120 00 E 1 AT STATION 31+00, MP= 5.26
SR 120 EASTBOUND

APPENDIX C

ROADWAY PHOTOGRAPHS (15 PAGES)

PHOTOGRAPH LEGEND

Photograph Type	Label Protocol	Project Information
County Number	A three digit number	135
Route Number	A four digit number followed by a two character suffix (i.e., SR 120 = 0120 00)	0120 00 BU = Business 03 = City 00 = CR or SR
Route Code	State or County or other code route	1 = State Highway 2 = County Road 3 = City Street
Direction of Travel	E, W, N or S	E = Eastbound W= Westbound N = Northbound S = Southbound
Lane of Travel	A one-digit number LTL RTL ML	1 LTL = Left Turn Lane RTL = Right Turn Lane ML = Merge Lane
With Traffic or Facing Traffic	W or F	W or F
Milepost	MP	MP 4.94 to MP 5.28

135 0120 00 1 E 1 F AT STATION 15+00, MP= 4.96
EASTBOUND, LANE 1, FACING TRAFFIC

135 0120 00 1 E 1 W AT STATION 15+00, MP= 4.96
EASTBOUND, LANE 1, WITH TRAFFIC

135 0120 00 1 W 1 W AT STATION 15+00, MP= 4.96
WESTBOUND, LANE 1, WITH TRAFFIC

135 0120 00 1 W 1 F AT STATION 15+00, MP= 4.96
WESTBOUND, LANE 1, FACING TRAFFIC

135 0120 00 1 W RTL W AT STATION 15+00, MP= 4.96
WESTBOUND, RIGHT TURN LANE, WITH TRAFFIC

135 0120 00 1 W RTL F AT STATION 15+00, MP= 4.96
WESTBOUND, RIGHT TURN LANE, FACING TRAFFIC

135 0120 00 1 E ML F AT STATION 20+00, MP= 5.05
EASTBOUND, MERGE LANE, FACING TRAFFIC

135 0120 00 1 E ML W AT STATION 20+00, MP= 5.05
EASTBOUND, MERGE LANE, WITH TRAFFIC

135 0120 00 1 E 1 F AT STATION 20+00, MP= 5.05
EASTBOUND, LANE 1, FACING TRAFFIC

135 0120 00 1 E 1 W AT STATION 20+00, MP= 5.05
EASTBOUND, LANE 1, WITH TRAFFIC

135 0120 00 1 W LTL W AT STATION 20+00, MP= 5.05
WESTBOUND, LEFT TURN LANE, WITH TRAFFIC

135 0120 00 1 W LTL F AT STATION 20+00, MP= 5.05
WESTBOUND, LEFT TURN LANE, FACING TRAFFIC

135 0120 00 1 W 1 W AT STATION 20+00, MP= 5.05
WESTBOUND, LANE 1, WITH TRAFFIC

135 0120 00 1 W 1 F AT STATION 20+00, MP= 5.05
WESTBOUND, LANE 1, FACING TRAFFIC

135 0120 00 1 W RTL W AT STATION 20+00, MP= 5.05
WESTBOUND, RIGHT TURN LANE, WITH TRAFFIC

135 0120 00 1 W RTL F AT STATION 20+00, MP= 5.05
WESTBOUND, RIGHT TURN LANE, FACING TRAFFIC

135 0120 00 1 E RTL W AT STATION 27+30, MP= 5.19
EASTBOUND, RIGHT TURN LANE, WITH TRAFFIC

135 0120 00 1 E 1 F AT STATION 27+00, MP= 5.18
EASTBOUND, LANE 1, FACING TRAFFIC

135 0120 00 1 E 1 W AT STATION 27+00, MP= 5.18
EASTBOUND, LANE 1, WITH TRAFFIC

135 0120 00 1 W 1 W AT STATION 27+00, MP= 5.18
WESTBOUND, LANE 1, WITH TRAFFIC

135 0120 00 1 W 1 F AT STATION 27+00, MP= 5.18
WESTBOUND, LANE 1, FACING TRAFFIC

135 0120 00 1 E 1 F AT STATION 31+20, MP= 5.26
EASTBOUND, LANE 1, FACING TRAFFIC

135 0120 00 1 E 1 W AT STATION 31+13, MP= 5.26
EASTBOUND, LANE 1, WITH TRAFFIC

135 0120 00 1 W LTL W AT STATION 31+00, MP= 5.26
WESTBOUND, LEFT TURN LANE, WITH TRAFFIC

135 0120 00 1 W LTL F AT STATION 31+00, MP= 5.26
WESTBOUND, LEFT TURN LANE, FACING TRAFFIC

135 0120 00 1 W 1 W AT STATION 31+00, MP= 5.26
WESTBOUND, LANE 1, WITH TRAFFIC

135 0120 00 1 W 1 F AT STATION 31+00, MP= 5.26
WESTBOUND, LANE 1, WITH TRAFFIC

135 0120 00 1 W RTL W AT STATION 31+00, MP= 5.26
WESTBOUND, RIGHT TURN LANE, WITH TRAFFIC

135 0120 00 1 W RTL F AT STATION 31+00, MP= 5.26
WESTBOUND, RIGHT TURN LANE, FACING TRAFFIC

APPENDIX D

EXAMPLE PHOTOGRAPHS (2 PAGES)

Load Distress – Severity Level 1 at Station 14+78, MP=4.95

Load Distress – Severity Level 2 at Station 30+07, MP= 5.24

Block/ Transverse Distress – Severity Level 1 at Station 31+54, MP= 5.27

Block/ Transverse Distress – Severity Level 1 at Station 30+85, MP= 5.26

APPENDIX E
CORE PHOTOGRAPHS (6 PAGES)

CORE C-1, SR 120, Sta. 14+41, Westbound, Lane 1, Passenger Wheel Path, MP= 4.95

CORE C-1, SR 120, Sta. 14+41, Westbound, Lane 1, Passenger Wheel Path, MP= 4.95, showing the other side of the core.

CORE C-2, SR 120, Sta. 16+18, Eastbound, Lane 1, Passenger Wheel Path, MP= 4.98

CORE C-3, SR 120, Sta. 18+38, Eastbound, Right Turn Lane, Driver Wheel Path, MP= 5.02

CORE C-4, SR 120, Sta. 19+21, Westbound, Lane 1, Passenger Wheel Path, MP= 5.04

CORE C-5, SR 120, Sta. 29+35, Eastbound, Right Turn Lane, Driver Wheel Path, MP= 5.23

CORE C-6, SR 120, Sta. 29+38, Westbound, Lane 1, Driver Wheel Path, MP= 5.23

CORE C-6, SR 120, Sta. 29+38, Westbound, Lane 1, Driver Wheel Path, MP= 5.23, showing the other side of the core

CORE C-6, SR 120, Sta. 29+38, Westbound, Lane 1, Driver Wheel Path, MP= 5.23, showing the fragmented portion of the core.

CORE C-6, SR 120, Sta. 29+38, Westbound, Lane 1, Driver Wheel Path, MP= 5.23, showing the top of the core

CORE C-7, SR 120, Sta. 31+65, Eastbound, Lane 1, Driver Wheel Path, MP= 5.27

CORE C-7, SR 120, Sta. 31+65, Eastbound, Lane 1, Driver Wheel Path, MP= 5.27, showing the other side of the core

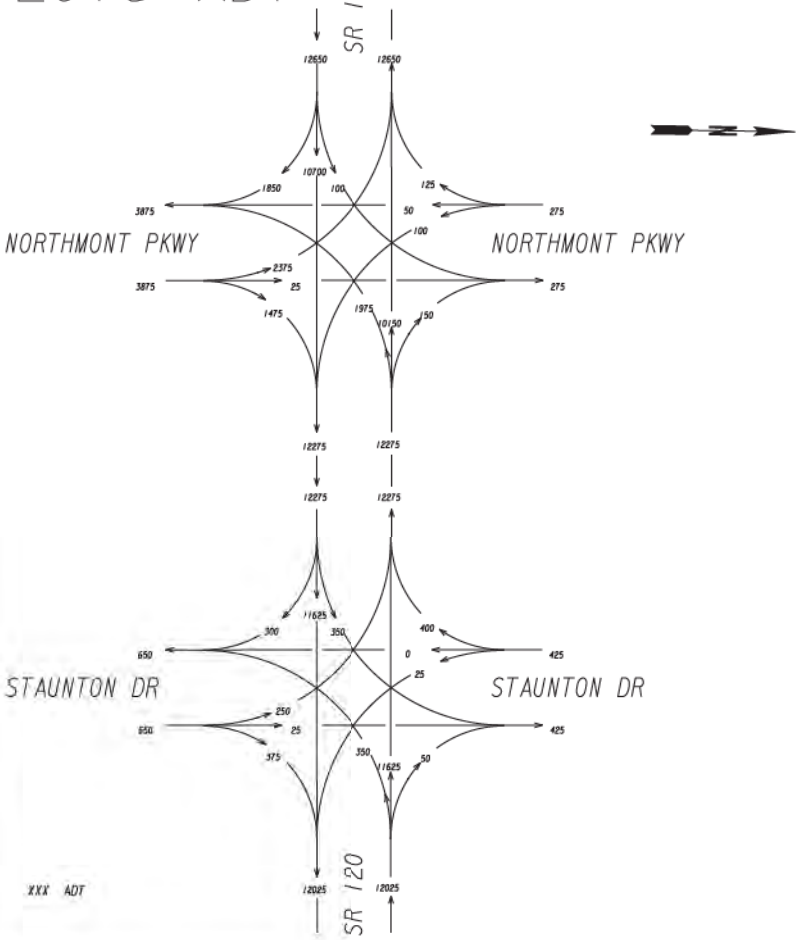
APPENDIX F
PAVEMENT RATING (EXCLUDED)

APPENDIX G

RECOMMENDED PAVEMENT SECTION (8 PAGES)

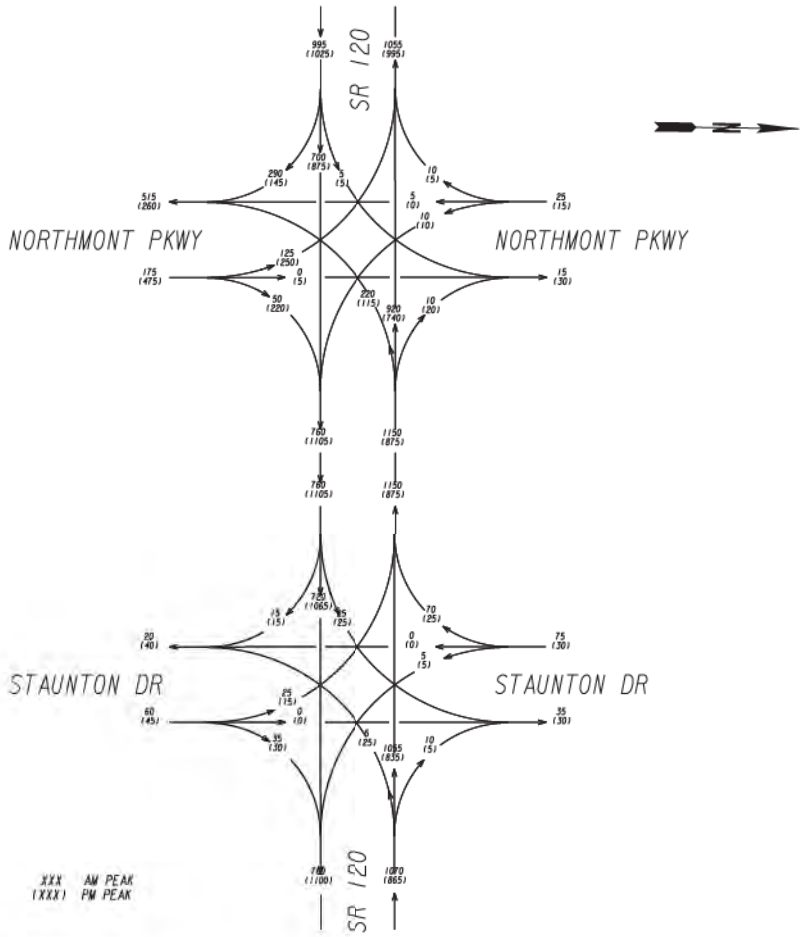
14-AUG-2015 09:26	9x26x13 AM	132986-TRDG	T:\Roadways\146615\132986\DGN\132986-TRDG.dgn	STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
bill.ruhsam		GDOT_11x17.pen		GA	P.I. 132986	1	5

2015 ADT



Daily Trucks		
Single Unit	Combination	Total
7.0%	1.0%	8.0%

2015 PEAK HOUR



Peak Hour Trucks		
Single Unit	Combination	Total
8.0%	1.0%	9.0%

PI 0132986
GWINNETT COUNTY
AUGUST 11, 2015
WMR/KMC

Michael Baker INTERNATIONAL
3595 ENGINEERING DRIVE
NORCROSS, GEORGIA 30092
(770) 263-918

GEORGIA
DEPARTMENT
OF
TRANSPORTATION

REVISION DATES

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE:

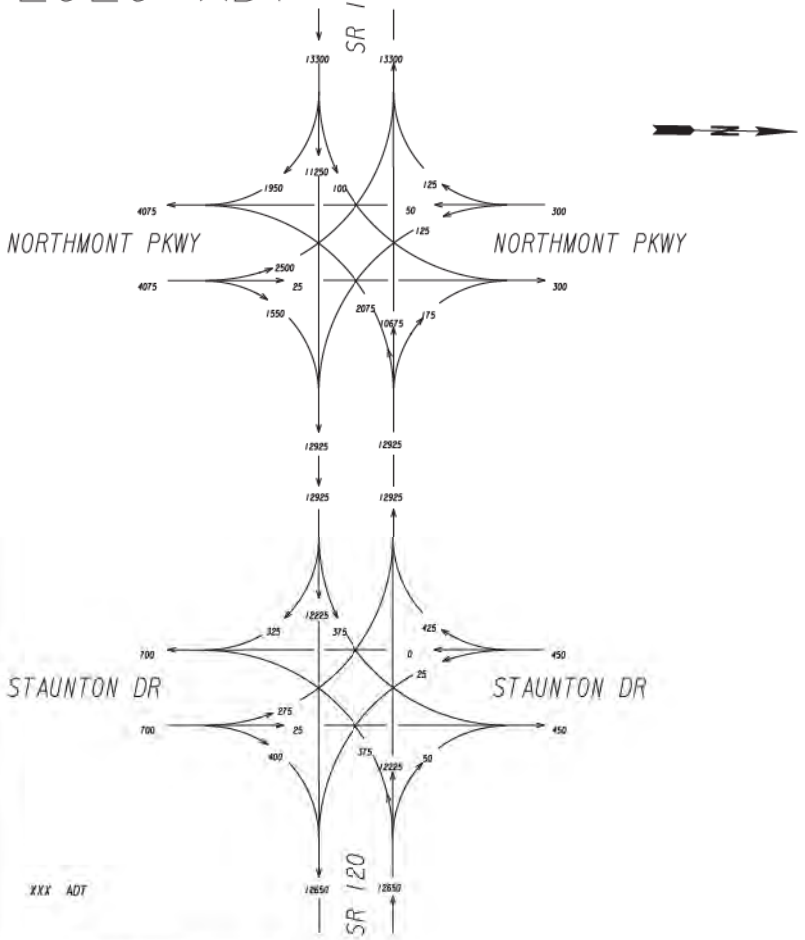
TRAFFIC DIAGRAM

SR 120 AT SINGLETON CREEK

DRAWING No. 10-001

14-AUG-2015 09:26	9x26x34 AM	132986-TRDG1	T:\Roadways\146615\132986\DGN\132986-TRDG.dgn	STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
bill.ruhsam		GDOT_11x17.pen		GA	P.I. 132986	2	5

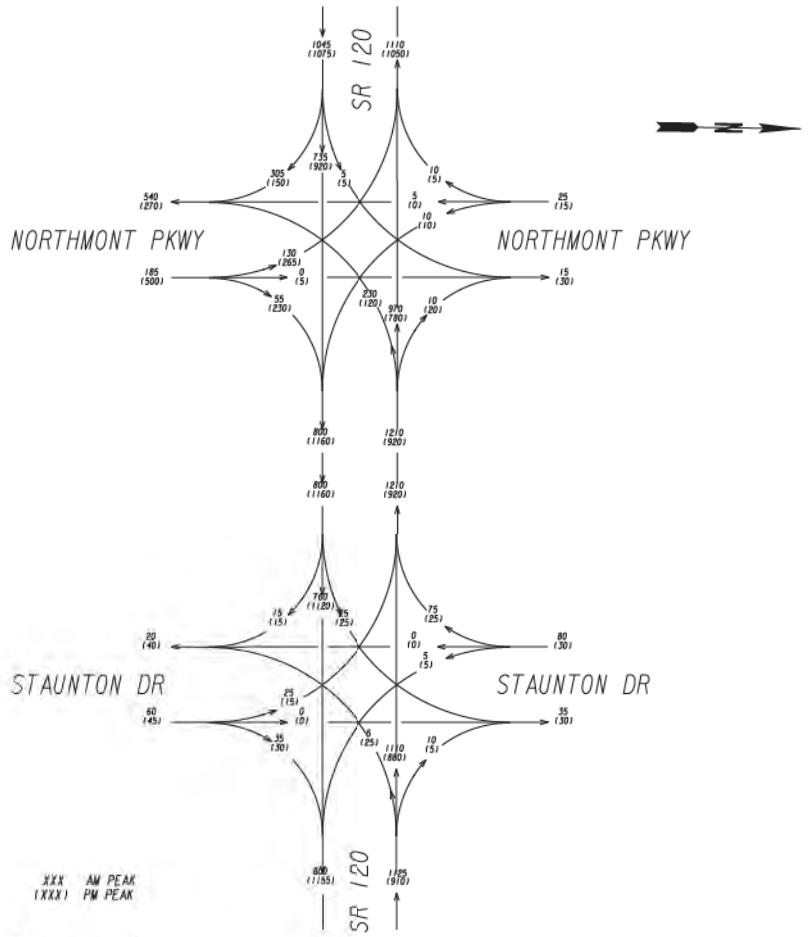
2020 ADT



Daily Trucks		
Single Unit	Combination	Total
7.0%	1.0%	8.0%

BUILD TRAFFIC IS THE SAME AS NO BUILD

2020 DESIGN HOUR



Peak Hour Trucks		
Single Unit	Combination	Total
8.0%	1.0%	9.0%

BUILD TRAFFIC IS THE SAME AS NO BUILD

PI 0132986
GWINNETT COUNTY
AUGUST 11, 2015
WMR/KMC

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GEORGIA DEPARTMENT OF TRANSPORTATION

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STATE OF GEORGIA
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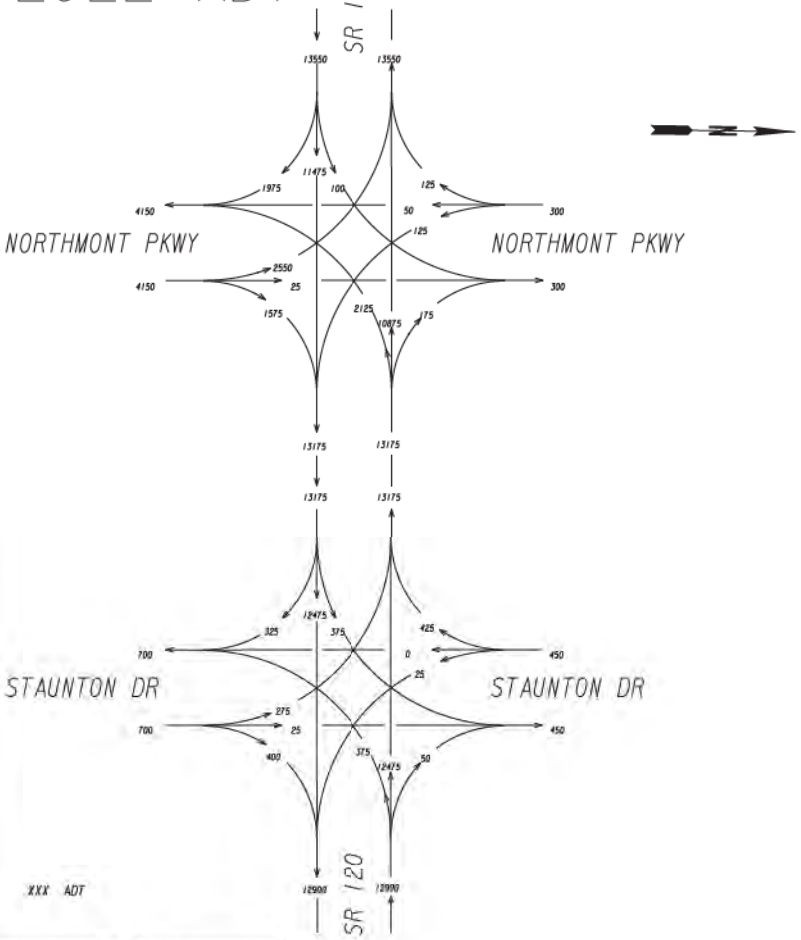
TRAFFIC DIAGRAM

SR 120 AT SINGLETON CREEK

DRAWING No. 10-002

14-AUG-2015 09:27	9x27x18 AM	132986-TRDG2	T:\Roadways\146615\132986\DGN\132986-TRDG.dgn	STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
bill.ruhsam		GDOT_11x17.pen		GA	P.I. 132986		

2022 ADT

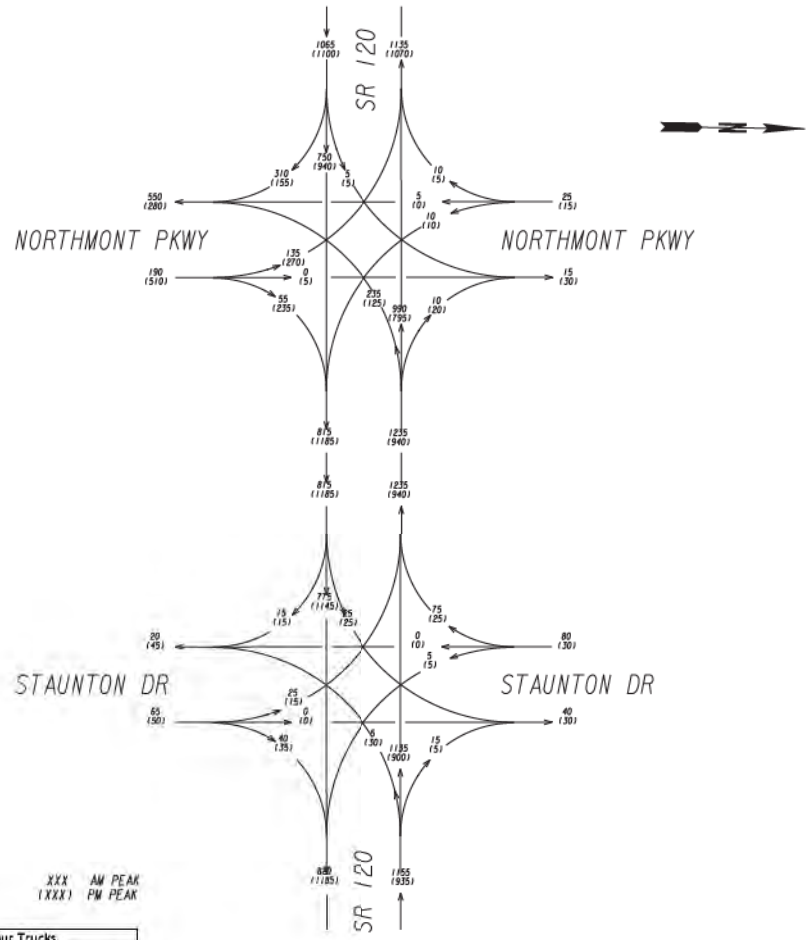


XXX ADT

Daily Trucks		
Single Unit	Combination	Total
7.0%	1.0%	8.0%

BUILD TRAFFIC IS THE SAME AS NO BUILD

2022 DESIGN HOUR



XXX AM PEAK
(XXX) PM PEAK

Peak Hour Trucks		
Single Unit	Combination	Total
8.0%	1.0%	9.0%

BUILD TRAFFIC IS THE SAME AS NO BUILD

PI 0132986
GWINNETT COUNTY
AUGUST 11, 2015
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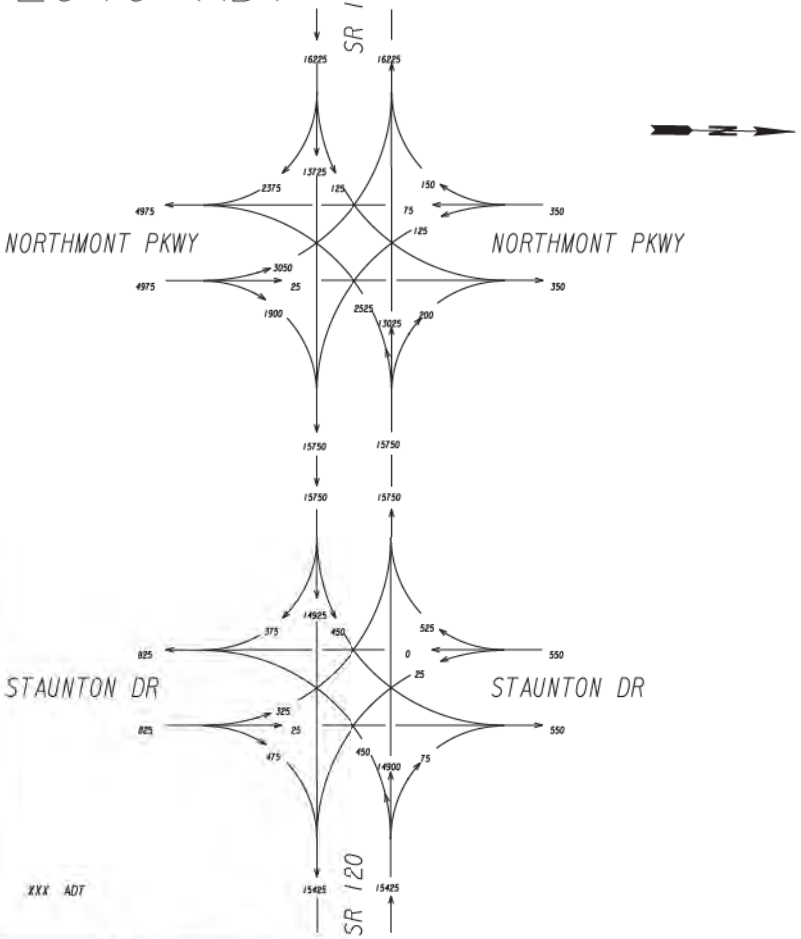
SR 120 AT SINGLETON CREEK

DRAWING No. 10-003

14-AUG-2015 09:27	9x27x26 AM	132986-TRDG3	T:\Roadways\146615\132986\DGN\132986-TRDG.dgn	STATE	PROJECT NUMBER	SHEET NO.	TOTAL SHEETS
bill.ruhsam		GDOT_11x17.pen		GA	P.I. 132986	4	5

2040 ADT

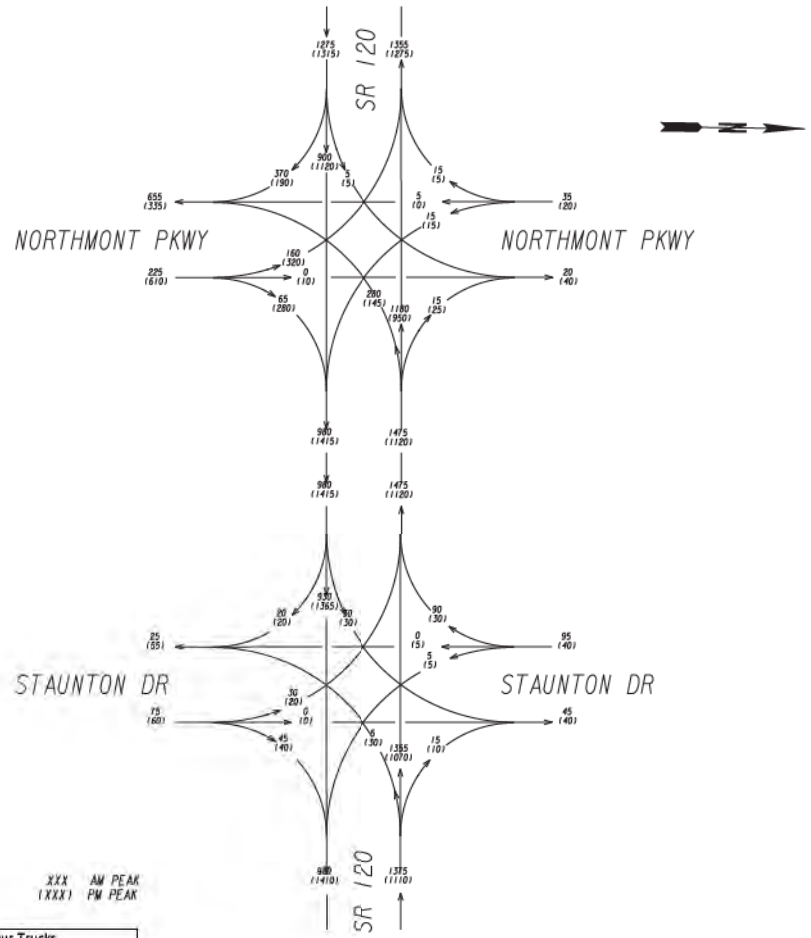


XXX ADT

Daily Trucks		
Single Unit	Combination	Total
7.0%	1.0%	8.0%

BUILD TRAFFIC IS THE SAME AS NO BUILD

2040 DESIGN HOUR



XXX AM PEAK
(XXX) PM PEAK

Peak Hour Trucks		
Single Unit	Combination	Total
8.0%	1.0%	9.0%

BUILD TRAFFIC IS THE SAME AS NO BUILD

PI 0132986
GWINNETT COUNTY
AUGUST 11, 2015
WMR/KMC

G- 4 of 8

Michael Baker INTERNATIONAL
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GEORGIA DEPARTMENT OF TRANSPORTATION

REVISION DATES

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE:

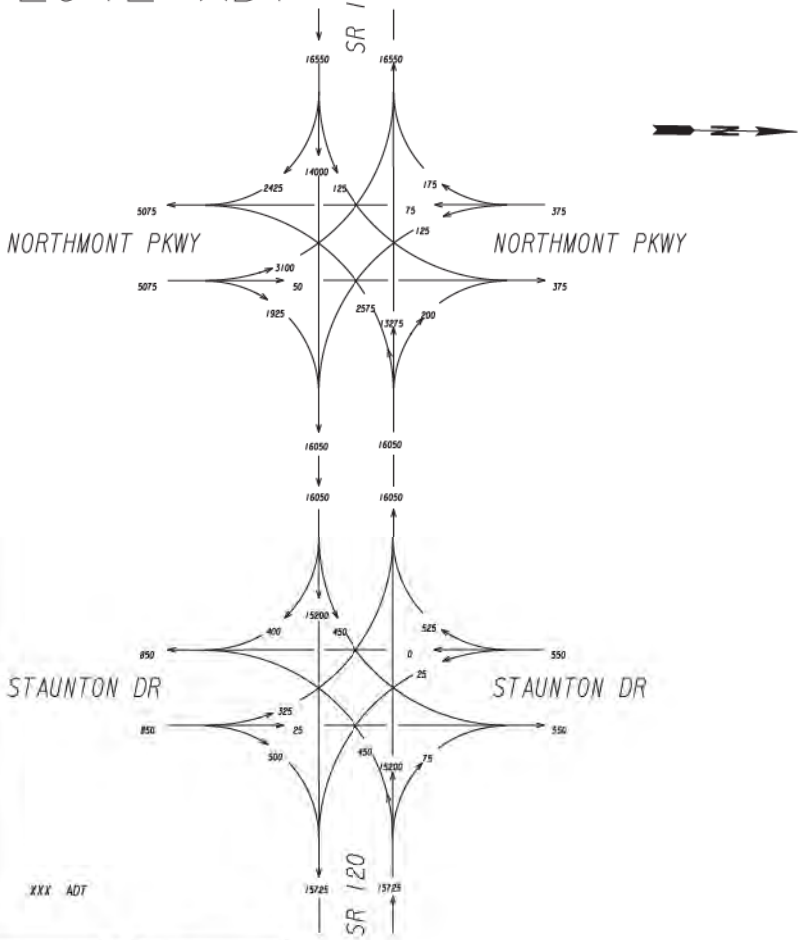
TRAFFIC DIAGRAM

SR 120 AT SINGLETON CREEK

DRAWING No. 10-004

14-AUG-2015 09:27 | 9x27x34 AM | 132986-TRDG4 | T:\Roadways\146615\132986\DGN\132986-TRDG.dgn | STATE: GA | PROJECT NUMBER: P.I. 132986 | SHEET NO. | TOTAL SHEETS
bill.ruhsam | GDOT_11x17.pen

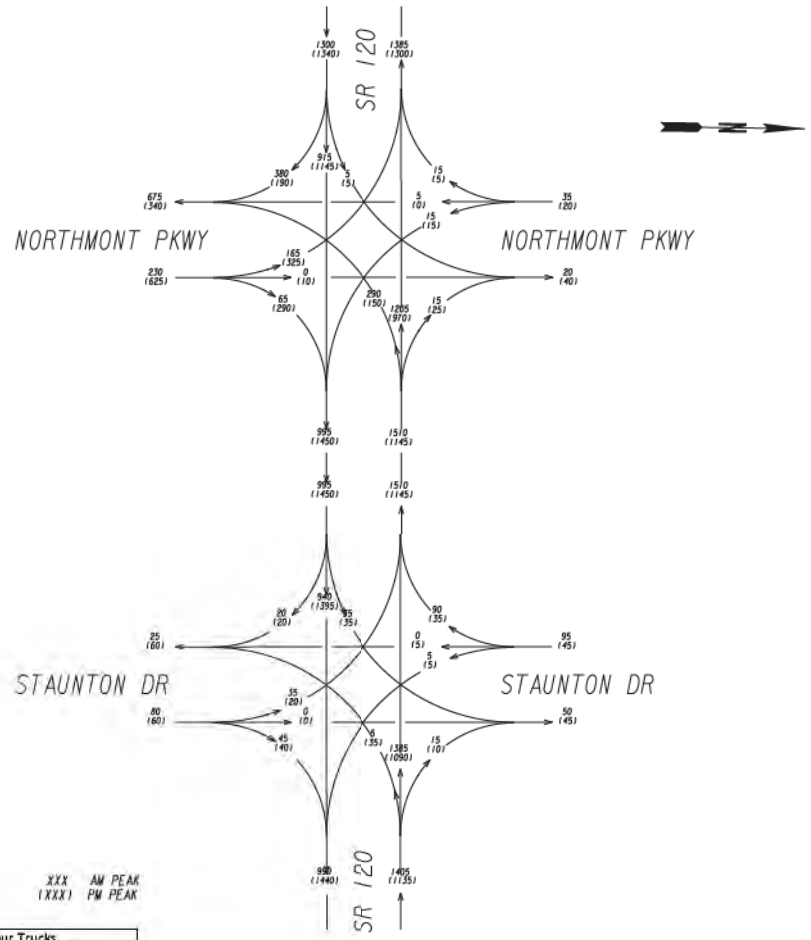
2042 ADT



Daily Trucks		
Single Unit	Combination	Total
7.0%	1.0%	8.0%

BUILD TRAFFIC IS THE SAME AS NO BUILD

2042 DESIGN HOUR



Peak Hour Trucks		
Single Unit	Combination	Total
8.0%	1.0%	9.0%

BUILD TRAFFIC IS THE SAME AS NO BUILD

PI 0132986
GWINNETT COUNTY
AUGUST 11, 2015
WMR/KMC

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GEORGIA DEPARTMENT OF TRANSPORTATION

REVISION DATES

STATE OF GEORGIA
DEPARTMENT OF TRANSPORTATION
OFFICE:

TRAFFIC DIAGRAM

SR 120 AT SINGLETON CREEK

DRAWING No. 10-005

Department of Transportation
State of Georgia

INTERDEPARTMENT CORRESPONDENCE

FILE BRST0-0189-01(030), Gwinnett County **OFFICE** Planning
P.I. # 132986

DATE August 14, 2015

FROM Cynthia L. VanDyke, State Transportation Planning Administrator

TO Albert Shelby, State Program Delivery Engineer
Attention: Anthony Tate

SUBJECT **Reviewed** Summary of Design Traffic Projections Memorandum Document and Design Traffic Diagrams for SR 120/DULUTH HIGHWAY @ SINGLETON CREEK 1.5 MI E OF DULUTH

Per request, we have reviewed the consultant's summary of design traffic projections memorandum document and design traffic diagrams for the above project. Based on the information furnished, we find the summary of design projections traffic memorandum document and the design traffic projections to be satisfactory, and approve the summary of design traffic projections memorandum document and the design traffic volume.

If you have any questions concerning this information please contact Andre Washington at (404) 631-1925.

CLV/AMW

Flexible Pavement Design Analysis

PI Number	0132986	**County(s)**	Gwinnett
Project Number		**Design Name**	Full Depth with GAB
Project Description	SR 120 Over Singleton Creek		

Traffic Data (AADTs are one-way)						**Miscellaneous Data**	
Initial Design Year	2020	**Initial AADT, VPD**	13,300	**24 Hour Truck %**	8.00	**Lanes in one direction**	1
Final Design Year	2040	**Final AADT, VPD**	16,225	**SU Truck %**	7.00	**Curb & Gutter/Barrier**	Yes
		Mean AADT, VPD	14,763	**MU Truck %**	1.00		

Design Data					
Lane Distribution Factor (%)	100.00	**Soil Support Value**	2.50	**Single Unit ESAL**	0.40
Terminal Serviceability Index	2.50	**Regional Factor**	1.80	**Multiple Unit ESAL**	1.50
		User Defined 18-KIP ESAL	0.00	**Calculated 18-KIP ESAL**	0.54
Non-Standard Value Comment					

Design Loading (Calculated 18-KIP ESAL)					
Mean AADT, VPD	**LDF (%)**	**Vehicle Type**	**Volume (%)**	**ESAL Factor**	**Daily ESAL**
14,763	100.00	Single Unit Truck	7.00	0.40	414
		Multi Unit Truck	1.00	1.50	222
				Total Daily ESALs	636
				Total Design Period ESALs	4,642,800

Proposed Flexible Full Depth Pavement Structure				
Course	**Material**	**Thickness (inches)**	**Structural Coefficient**	**Structural Value**
Course 1	12.5 mm Superpave, Polymer Modified	1.50	0.4400	0.66
Course 2	19 mm Superpave	2.00	0.4400	0.88
Course 3	25 mm Superpave	1.00	0.4400	0.44
		5.00	0.3000	1.50
Course 4	Graded Aggregate Base	12.00	0.1600	1.92

Required SN 5.74 **Proposed pavement is 5.87% Underdesigned** **Proposed SN** 5.40

Design Remarks	Full Depth with GAB

Prepared By 8/28/2015 1:38 PM

UC **Date**

Recommended By

State Roadway Design Engineer **Date**

Approved By

State Pavement Engineer **Date**

Flexible Pavement Design Analysis

PI Number	0132986	**County(s)**	Gwinnett
Project Number		**Design Name**	Overlay
Project Description	SR 120 Over Singleton Creek		

Traffic Data (AADTs are one-way)						**Miscellaneous Data**	
Initial Design Year	2020	**Initial AADT, VPD**	13,300	**24 Hour Truck %**	8.00	**Lanes in one direction**	1
Final Design Year	2040	**Final AADT, VPD**	16,225	**SU Truck %**	7.00	**Curb & Gutter/Barrier**	Yes
		Mean AADT, VPD	14,763	**MU Truck %**	1.00	**Milling Depth (inches)**	2.00

Design Data					
Lane Distribution Factor (%)	100.00	**Soil Support Value**	2.50	**Single Unit ESAL**	0.40
Terminal Serviceability Index	2.50	**Regional Factor**	1.80	**Multiple Unit ESAL**	1.50
		User Defined 18-KIP ESAL	0.00	**Calculated 18-KIP ESAL**	0.54
Non-Standard Value Comment					

Design Loading (Calculated 18-KIP ESAL)					
Mean AADT, VPD	**LDF (%)**	**Vehicle Type**	**Volume (%)**	**ESAL Factor**	**Daily ESAL**
14,763	100.00	Single Unit Truck	7.00	0.40	414
		Multi Unit Truck	1.00	1.50	222
				Total Daily ESALs	636
				Total Design Period ESALs	4,642,800

Proposed Flexible Overlay Pavement Structure				
Course	**Material**	**Thickness (inches)**	**Structural Coefficient**	**Structural Value**
Overlay 1	12.5 mm Superpave, Polymer Modified	1.50	0.4400	0.66
Overlay 2	19 mm Superpave	2.00	0.4400	0.88
Overlay 3	25 mm Superpave	1.00	0.4400	0.44
		2.00	0.3000	0.60
Existing 1	Asphaltic Concrete	5.50	0.3000	1.65
Existing 2	Graded Aggregate Base	8.50	0.1600	1.36

Required SN 5.74 **Proposed pavement is 2.56% Underdesigned** **Proposed SN** 5.59

Design Remarks	Overlay

Prepared By UC 8/28/2015 1:43 PM
Date

Recommended By
State Roadway Design Engineer **Date**

Approved By
State Pavement Engineer **Date**

APPENDIX H

ROADWAY SURVEY AND CORE PROPERTIES (4 PAGES)

APPENDIX H
ROADWAY DESIGNATION

For **SR 120**, the roadway designation is considered an east-west oriented roadway. Travel lanes are designated with numbers. Lane 1 = Eastbound (EB), Westbound (WB), Inside Lane closest to the centerline of the existing roadway. Left Turn Lane (LTL) is to the left of Lane 1 in the direction of travel, and it separates eastbound and westbound travel lanes close to the intersections. Right Turn Lane (RTL) is the outside lane, closest to the right edge of the pavement.

EXISTING PAVEMENT SURVEY

This project consisted of evaluation of the existing roadway and shoulders for the realignment/ improvement of **SR 120 across Singleton Creek.** The total length of the existing pavement evaluation sections of the project was approximately 1,800 feet. This project began at Station 14+00, Mile Marker (MM) = 4.94. The project continues in an eastbound direction to Station 32+00, MM 5.28. The station locations and all roadways associated with this project were not provided or staked in the field by a surveyor. United Consulting determined the approximate location of these stations by using a measuring wheel from the nearest identified stationary object marked on the provided plans.

SR 120
From: Station 14+00± to Station 20+90±.
The existing pavement/alignment consists of flexible asphalt concrete pavement with two (2) main travel lanes. There is one (1) eastbound and one (1) westbound non-divided travel lanes, and a left turn lanes and a right turn lanes in the areas near the intersection with Northmont Parkway.

Pavement Conditions: Fair to Good. The field observation findings rated the existing roadway conditions as follows: Severity rating, level 1 load cracking and level 1 block/transverse cracking were observed within the evaluated segmented area. The width of the main travel lanes for the section of roadway ranged from 11.5 feet to 13 feet.

Shoulder/ Structure and Drainage Conditions: The unpaved shoulder width varied from 1 foot to 10+ feet depending on location. Shoulders appeared to be well maintained. Concrete curb and gutter existed in the areas near the intersections along with two storm water catch basins.

From: Station 20+90± to Station 26+28±.

The proposed new horizontal alignment travel south of the existing roadway and therefore no pavement evaluation was performed on this section of roadway.

From: Station 26+28± to Station 32+00±.

The existing pavement/alignment consists of flexible asphalt concrete pavement with two (2) main travel lanes. There is one (1) eastbound and one (1) westbound non-divided travel lanes, and a left turn lanes and right turn lanes in the areas near the intersection with Staunton Drive.

Pavement Conditions: Fair to Good. The field observation findings rated the existing roadway conditions as follows: Severity rating, level 1 and level 2 load cracking and level 1 block/transverse cracking were observed within the evaluated segmented area. The width of the main travel lanes for the section of roadway ranged from 11.5 feet to 12.5 feet.

Shoulder/ Structure and Drainage Conditions: The unpaved shoulder width varied from 1 foot to greater than 10 feet depending on location. Shoulders appeared to be well maintained. Concrete curb and gutter existed in the areas near the intersections along with two storm water catch basins.

Side Roads
No pavement evaluation was performed on the side roads during this survey.

ROADWAY EVALUATION

Note: Distresses not listed within the following roadway evaluated segmented areas were not observed during this survey.

Rutting
On **SR 120,** rutting measurements were evaluated at various locations. Rutting measurements ranged from a minimum of zero inches to a maximum of ⅛ inches near the intersections with Northmont Parkway and Staunton Drive within the evaluated sections to be retained. Measurements are provided to the nearest $^1/_8$ inch increments.

Designation for wheel paths are as follows: Drivers Wheel Path = DW, Passenger Wheel Path = PW, Eastbound = EB, Westbound = WB, Right Turn Lane = RTL, Left Turn Lane = LTL.

SR 120

Station	WB RTL		WB Lane 1		WB LTL		EB LTL		EB Lane 1		EB RTL	
	PW	DW	PW	DW	PW	DW	DW	PW	DW	PW	DW	PW
14+41±	0	0	⅛	0					0	0		
16+18±			0	0					0	0		
18+38±			0	0			0	0	⅛	⅛	0	0
19+21±	0	0	0	⅛	0	0			0	0		
19+49±	0	0	0	0	0	⅛			0	0		
29+35±			0	0			0	⅛	0	0	0	0
29+38±			0	0			0	0	0	0	0	0
30+21±	0	0	0	0	0	⅛			0	0		
31+65±			0	0	⅛	0			0	0		

Load Cracking

On **SR 120,** Level 1 to Level 2 load cracking was observed from the following evaluated sections:

Station to Station		Load Cracking (%)			
Evaluated Test Section	Representing	Level 1	Level 2	Level 3	Level 4
14+00 – 15+00 WB, Lane 1	14+00± to 20+90±	90	0	0	0
14+00 – 15+00 EB, Lane 1		70	0	0	0
30+00 – 31+00 WB, Lane 1	26+28± to 32+00±	60	5	0	0
30+00 – 31+00 WB, Left Turn Lane		55	0	0	0
30+00 – 31+00 EB, Lane 1		75	0	0	0

Block/Transverse Cracking

On **SR 120,** Level 1 block/transverse cracking was observed from the following evaluated sections:

Station to Station		Block/ Transverse Cracking (%)		
Evaluated Test Section	Representing	Level 1	Level 2	Level 3
14+00 – 15+00 WB, Lane 1	14+00± to 20+90±	35	0	0
14+00 – 15+00 EB, Lane 1		0	0	0
30+00 – 31+00 WB, Lane 1	26+28± to 32+00±	5	0	0
30+00 – 31+00 WB, Left Turn Lane		60	0	0
30+00 – 31+00 EB, Lane 1		20	0	0

ASPHALT CORE PROPERTIES LENGTH/TYPE

Core/ Sample Number	Location	Station/Location/ Direction	Asphalt Core Length (ins)	Asphalt Type/ Depth (ins.)
				Top to Bottom
C-1	SR 120	Station 14+41 WB, Ln 1, 13' Lt, PW	5.50	F=2.00, E=1.25, F=2.25
C-2	SR 120	Station 16+18 EB, Ln 1, 18' Rt, PW	18.00	F=1.00, F=1.25, E=1.25, F=1.25, E=3.00, B=2.75, B=1.50, B=6.00
C-3	SR 120	Station 18+38 EB, RTL, 43' Rt, DW	7.50	F=1.00, F=1.50, B=0.75, B=2.00, B=2.25
C-4	SR 120	Station 19+21 WB, Ln 1, 27.25' Lt, PW	9.00	E=1.25, F=1.00, F=1.25, E=2.00, B=3.50
C-5	SR 120	Station 29+35 EB, RTL, 29.00' Rt, DW	9.00	F=1.00, E=1.25, B=2.75, B=4.00
C-6	SR 120	Station 29+38 WB, Ln 1, 4.50' Lt, DW	21.00	E=1.50, F=1.50, F=2.00, E=1.00, E=1.50, E=2.50, E=3.00, B=3.00, B=3.00, B=2.00
C-7	SR 120	Station 31+65 EB, Ln 1, 4.00' Rt, DW	10.00	F=2.00, E=2.00, F=1.25, E=2.25, E=1.00, B=1.50

Notation:
DW = Driver's Wheel Path
EB = Eastbound
Ln = Designated Travel Lane
Lt = Left of the existing centerline, direction of travel (lower to higher station)

PW = Passengers Wheel Path
Rt = Right of the existing centerline, direction of travel (lower to higher station)
RTL = Right Turn Lane
WB = Westbound

Asphalt Type:
F= Asphalt mix with < ⅜ inch stone size matrix
E= Asphalt mix with < ¾ inch stone size matrix
Bin = Binder = Black mix
B=Base = Asphalt mix with > ¾ inch stone size matrix

APPENDIX I

DISC

Concept Team Meeting Minutes
P.I. 132986

Date: **December 18, 2015 @ 10:00 a.m.**
Location: **GDOT District 1 large conference room**
RE: **P.I. 132986 – SR 120 over Singleton Creek – Gwinnett County**
Attendees: **See attached list**

Welcome:
Anthony Tate welcomed everyone and gave a brief introduction of the project. This is an old project that is being rebooted. Several years ago it went to final plans but was then shelved. Now it is back at concept stage to validate the concept and proceed through letting.

Introductions:
Everyone introduced themselves and was requested to fill out the sign in sheet

Project Identification:
Anthony Tate gave the project specifics and outlined the schedule:

PFPR - November 2016
Environmental Approval - April 2017
R/W Authorization - June 2017
FFPR - December 2017
Letting - June 2018

Concept Report:
Ben Clopper revised the concept report and invited attendees to stop him if items needed additional clarification

- Project Justification: Existing bridge was built in 1938. Sufficiency rating of 58.7 on 1/31/2014. Generally satisfactory condition but cracking and spalling on edge beams, bent 2 and abutment 4. Designed using H-15 vehicles, which is below current design standards. Unknown foundation type so there is a risk of scour. The Bridge Office has recommended the bridge for replacement for those two reasons.
- Existing conditions: Two – 12-foot lanes, variable width paved shoulders. Existing bridge has no shoulders. Signalized intersection west of the bridge. There is some existing sidewalk, though on east side it is without C&G. The property along the north side of the bridge is protected by a restrictive covenant by the USACE.
- Approved Traffic: 2015 ADT: 25,300, Open (2020) ADT: 26,6600, Design (2040) ADT: 32,420
- Functional Classification: Urban Minor Arterial
- Pavement Evaluation:
    - Full Depth: 1.5”, 2”, 6”, 12” GAB
    - Mill/Inlay: 1.5”, 2” 3” (remove cracking)
- Structures were discussed by George Manning:
    - Existing Bridge: 75’ long, 3 span, 26.5’ wide with two-12’ lanes and no shoulders
    - Proposed Bridge: 150’ long, 3 span, 56.4’ wide with two-12’ lanes, 14’ center turn lane, 2’ gutters and 6’ raised sidewalk
    - Proposed bridge will be raised from ~904.5 to ~909.0 to get 2’ clearance over 50’ Yr flood elevation (902.78)

- Proposed Design Features were reviewed by Ben Clopper:
    - Two 12-foot lanes with a 14-foot center turn lane and 16' border area including sidewalks
    - 45 mph design speed which matches existing posted speed limit.
    - Design Vehicle is a WB-40 per Design Policy Manual (DPM). Comment from Office of Design Policy and Support (DP&S) concerning WB-67 given 8% truck traffic. May be useful for south leg of Northmont Pkwy, but all other sideroads are residential.
    - Discussion about a design variance for Median Usage: DPM calls for a 24' median given the Functional Classification and Design Speed. However the rest of SR 120 is only 2 lanes for 1 mile to east and through Duluth and Johns Creek almost to Alpharetta to the west. This is a bridge project so it would be desirable to get the full future width in place, but there is nothing programmed and future widening seems unlikely.
        - Justin Lott agreed that a design variance is not needed if there is no need to go to four lanes.
        - Justin will investigate and confirm that there are no plans to widen SR 120. [This was completed and no programmed projects were identified]
    - 1 signalized intersection at SR 120 at Northmont Pkwy
    - No lighting
    - No detour required, staged construction. No nearby state routes are available for a detour
- Design Exception (DE)/Design Variance (DV):
    - No DE required
    - DV may be required for median – suggested by DP&S. Based on the discussions at the meeting the attendees did not think a DV was necessary.
- Utilities:
    - SUE QL-B is almost completed and there are a lot of utilities in the project area. The SUE was not available prior to submitting the Concept for the Concept Team Meeting, so utilities were not taken into account, but can be discussed now.
    - Include:
        - 48" water on south side
        - 12" (new) & 4" gas on south side
        - Fiber and multi-duct telephone on south side
        - Overhead electric and telephone on south side
        - 16" water on north side
        - Buried electric on north side
        - Multi-duct telephone on north side
        - Sanitary sewer along creek
    - District has been working on a Utility Cost Estimate. It is not available at this time but it will be included in the Concept Report when it is ready
    - All utilities appear to be located within the existing R/W except for the new 12" gas line and overhead electric/phone on the south side of the road
    - The bridge can be designed to minimize impacts to utilities. The problem will be maintaining existing utilities underneath the realigned roadway. Utility relocations will be expensive if they are necessary for the large utilities.
    - Public Interest Determination (PID). The need for a PID was discussed and the District Utilities Office will review and provide input to the project manager

    - David Wagoner stated that AT&T would like to retain the duct bank on south side. It contains many cables and would be very costly to move. He did not think it would be a problem to maintain it underneath the new roadway because it is expected that it is located at a depth below where any work would be done. Lynn Palmer expressed concern about access to the line. David said they wouldn't need access because of the proximity of manholes along the project corridor. That line is a trunk line and local distribution is up on poles (overhead).
    - Tasheena Spearman requested more details related to the placement of the bridge relative to the 24" sanitary sewer. Ben Clopper stated that the manhole on this line south of the bridge will be impacted. Tasheena said she would send some details to the engineer about what will be required for replacing the manhole, cut, etc.
    - Ben Clopper stated that Pothole testing (QL-A) will be performed later in the design process. David Wagoner asked if the utility owners can we get QL-A before the first submittal? Ben Clopper said QL-A won't be done until after the utility impact plans, generally in Final Plans. First submission is a verification submittal of the SUE plans
    - John Gay stated that Georgia Power has a relocation already designed through this area and may be able to use those plans when the time comes.
- R/W:
    - Existing varies 80-120'
    - Proposed varies 100-190'
    - Estimate 10 parcels affected with no displacements
    - R/W office is working on a cost estimate and it will be included in the Concept Report when it is received.
- Roundabout:
    - A roundabout was considered but was determined to be outside of the scope of this bridge replacement project.
- Context Sensitive Solutions:
    - None currently included
- Environmental: A summary was provided by Paul Condit
    - MS4 Compliance (by Ben Clopper): – The concept MS4 study included in the Concept Report shows that there are five drainage areas along the corridor, but only the one in the northeast quadrant of the bridge will require post construction BMPs. There is sufficient existing R/W at this location to install the post construction BMPs. The other drainage areas either have reduced pavement areas or the installation of permanent BMPs would require residential displacements.
    - A Categorical Exclusion (CE) is the expected NEPA document
    - A Clean Water Act Section 404 Permit will be required and a Buffer Variance may be necessary. NPDES and FEMA coordination is required
    - Ecology – 3 buffered waters and 2 wetlands. No suitable habitat for T&E species, including aquatics. Property to north has a permanent restrictive covenant for wetland preservation, and reversing this would be time consuming and costly. Extinguishment of the restrictive covenant would require a new Section 404 Individual Permit for the original impacts, and the compensatory mitigation would have to be provided at a 2:1 ratio for the current owner of the property, the Bentwood Homeowners Association.
    - History & Archaeology – Surveys have been completed and no resources identified.
        - Elliot Robertson asked who is the ecologist that is reviewing the ecology study? Paul Condit replied that he did not know, he did not think one had been assigned yet. Anthony Tate stated he thought it was Christina Schmidt.

        - Elliot Robertson asked what would be the change in elevation of the bridge. George Manning answered about 4 feet. Elliot reminded the team that this may need to be taken into account for the noise study. Paul Condit replied that Baker will look at the Environmental Procedures Manual to ensure the criteria are followed for noise study purposes.
    - Air/Noise – Exempt from conforming plan because of project type; however, screenings are required
    - Public Involvement – None required or expected
- Construction:
    - None noted in Draft CR but Utilities are probably going to be an issue
- Coordination
    - This is an old project, ICTM was held on 6/5/2002 and CR was approved on 2/11/2003. The consultant team was asked to relook at Concept and provide updated Concept Report in new format instead of just making a revision.
    - Michael Baker International is responsible for Concept Development, Design and Environmental Studies.
    - GDOT responsible for other activities.
- Costs
    - Construction $2.5 million
    - Mitigation: $50k
    - Waiting on Util and R/W
- Other Alternatives
    - No Build – does not meet project need
    - Replace to north – no room because of restrictive covenant, longitudinal impacts to one stream and two buffers
    - Replace on existing alignment – cannot stage due to bridge needing to be raised 4.5'. No nearby State Routes are available for detour

Concept Layout

Ben Clopper reviewed the Concept Layout

- SR 120 is being realigned to south. Long horizontal curve from west of Northmont across bridge, allows the superelevation to be constant through bridge
- Vertical alignment has sag curves on either side of bridge with low point on west side, off the bridge and minimal grade across bridge
- Locations of wetlands and waters are shown on the plans. The property with the restrictive covenant will be identified.
- The side streets maintain their existing lane configuration

Project Risks:

Anthony Tate led a discussion on project risks using the Comprehensive Risk Assessment for Transportation (CRAFT) tool. The heat map is attached.

Public Involvement Plan:

No public involvement is require for this project.

Comments from attendees:

- The utility companies requested to receive submissions as soon as possible. Ben Clopper replied that the SUE subconsultant was completing the QL-B plans now and the utility owners should receive plans for verification early next year.
- Justin Lott confirmed that there was no super elevation (SE) transition on the bridge
- Justin Lott asked about the maximum proposed SE rate shown in the Concept Report of 6%. Ben Clopper replied that this was to match the existing SE on SR 120 and that this would be noted in the Concept Report.
- Justin Lott suggested including the form for contingency costs so this can be captured in the estimate. Anthony Tate will provide this form to Ben Clopper
- John Gay asked when design plans will be available for utility companies. Ben Clopper stated that currently the consultant is only scoped through Concept plans but is currently negotiating for preliminary design. Based on the schedule preliminary plans would be available by the middle of 2016.

Field Visit:
The field visit was attended by Anthony Tate, Elliot Robertson, Ben Clopper, Paul Condit, George Manning and Bill Ruhsam. The relation of the proposed bridge to existing utilities was discussed. High traffic volumes were noted.

Attachments:
Sign In Sheet
Agenda
CRAFT tool heat map

Sign In Sheet
Concept Team Meeting
PI 132986 - Gwinnett County
SR 120 over Singleton Creek
12/18/2015
District 1 Office, Gainseville, GA

Name	GDOT Office/Company	Phone	Email
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GEORGE MANNING	MICHAEL BAKER	678-966-6629	GEORGE.MANNING@MBAKERINTL.COM
Anthony Tate	GDOT - Program Delivery	404-631-1769	atate@dot.ga.gov
TaSheena Spearman	GCDWR-	678-376-6742	tasheena.spearman@gwinnettcounty.com
DAVID WAGONER	AT+T	404-532-7704	DW7820@ATT.COM
Lynn Palmer	GDOT - Utilities	770-531-5752	jlpalmer@dot.ga.gov
JOHN GAY	GPC	404-29/-0622	JCGAY@SOUTHERNCO.COM
Justin Lott	GDOT - D1	770-531-5745	jlott@dot.ga.gov

Georgia Department of Transportation

CONCEPT TEAM MEETING AGENDA For PI 132986 - Gwinnett County

Monday December 18, 2015

10:00 a.m.

Meeting Location: District 1 Office large conference room located at

2505 Athens Highway, Gainesville, GA 30507

1. Welcome – Anthony Tate, GDOT Project Manager
2. Sign-in sheet
3. Attendee (self) Introduction
   a. Project Identification – Georgia Department of Transportation (GDOT)
   b. Project Name: SR 120/DULUTH HIGHWAY @ SINGLETON CREEK 1.5 MI E OF DULUTH
   c. Project County: Gwinnett County
   d. Project Identification Number: 132986-
4. Schedule – Anthony Tate, GDOT Project Manager
5. Review Concept Report – Design Team
6. Review Concept Layout – Design Team
7. Assess Project Risks – Project Team
8. Review Public Involvement Plan (if applicable) – Project Team
9. Comments/questions (from attendees in the following order)

   a. Local Government Officials
      - State
      - County
      - City
   b. Office of Design Policy and Support
   c. Office of Planning
   d. Office of Financial Management
   e. Office of Engineering Services
   f. Office of Traffic Operations
   g. Office of Environmental Services
   h. District Preconstruction
   i. Office of Right of Way
   j. Office of Construction
   k. GDOT Office of Utilities
   l. Individual Utility Companies (in attendance)
   n. Other attendees

Note: Project Site Visit to follow concept team meeting

Heat MAP

Bridge Design	Construction	Design Policy	District	Environmental	OMAT	Project Management	Roadway Design	Right Of Way	Traffic Operation	Utilities	Risk Legend
Hydraulic Issues.	Constructability Issues.	Survey Availability Issues.	Local Government Support.	Major Natural Environment Issues.	Project is at Areas with less than Desirable Soil.	Funding Issues.	Geometric Issues.	Project in Residential Area.	Safety Issues.	Railroad Involvement.	Low
Structural or Foundation Issues.	Access Issues.	Erosion Control Issues.	Local Stakeholder (citizens) Support.	Major Human Environment Issues.	Pavement Design Issues.	Schedule Issues.	Potential Drainage Issues.	Project in Commercial Area.	Traffic Signal Justifications or Permits.	Major Utilities.	Medium Low
Constructability Issues.	Issues with Payment.	MS4 Issues.	Coordination Among different Entities.	Significant Coordination Issues.		Scope Issues.	Traffic Analysis or Capacity Issues.	Access Issues in the Project Corridor.	New Equipment.	Relocation of Major Utilities.	Medium
Environmental Issues.				Significant Time Constraints for Studies or Permits.			Utility Conflict Issues.	Displacement Issues in the Project Corridor.		Known Utility Coordination Issues.	Medium High
				Environmental Impact Statement (EIS).			Staging or Constructability Issues.	Properties with Potential Contaminated Soils.		SUE or PID.	High
								Environmental Issues.			